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Sacramento District

Engineering Division

Sutter Basin Pilot Feasibility Report - Environmental Impact Report / Supplemental Environmental Impacts Statement

Butte and Sutter Counties, California

Appendix C: Engineering Appendix

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ACRONYMS

ACE Annual Chance of Exceedance
ADWS Authorized Design Water Surface
ATOL Authorized Top of Levee
AEP Annual Exceedance Probability
APE Area of Potential Effect
AST Above Ground Storage Tank
BMP Best Management Practice
CCEL Cherokee Canal East Levee
CDFW California Department of Fish and Wildlife
CEQA California Environmental Quality Act
CFS Cubic Feet Per Second
COE The Corps of Engineers
CVFED Central Valley Floodplain Evaluation and Delineation
CVFPB Central Valley Flood Protection Board
CSA Cultural Site Assessment
Cy Cubic Yards
DFG California Department of Fish and Game
DWR California Department of Water Resource
DWS Design Water Surface
DWSE Design Water Surface Elevation
DSM Deep Soil Mixing
ESA Environmental Site Assessment
ETL Engineering Technical Letter
EIP Early Implementation Project
EPA Environmental Protection Agency
FDA Flood Damage Assessment
FRWL Feather River West Levee
FRM Flood Reduction Measures
HPTRM High Performance Turf Reinforced Mat
HTOL Hydraulic Top of Levee
HTRW Hazardous, Toxic and Radioactive Wastes
LEERD Land, Easements, Rights-of-way, Relocation and Disposal Areas
LiDAR Light Detection and Ranging
LMA Levee Maintenance Authorities
LD Levee District
LSO Levee Safety Officer
LSPM Levee Safety Program Manager
MEIP Modified Early Implementation Project
NMFF National Marine Fishery Service
NHPA National Historic Preservation Act
NPDES National Pollution Discharge Elimination System
OMRR&R Operation and Maintenance, Repair, Replacement and Rehabilitation
PA Programmatic Agreement
PCA Project Cooperation Agreement
PCB Polychlorinated biphenyl
PDT Project Delivery Team

PED Preconstruction Engineering and Design
REP Real Estate Plan
PFR Plan Formulation Report
PLM Project Levee Mile
ROW Right-of-Way
RWQCB Regional Water Quality Control Board
SOP Standard of Practice
SBFS Sutter Basin Feasibility Study
SBEL Sutter Bypass East Levee
SBMC Sutter Butte Main Canal
SBFCA Sutter Butte Flood Control Agency
SBFIP Star Bend Fix-in-place
SBLS Sutter Basin Levee System
SBL Sutter Bypass Levee
SHPO State Historic Preservation Office
ULE Urban Levee Evaluation
UPRR Union Pacific Railroad
USACE United States Army Corps. of Engineers
USFWS U.S. Fish and Wildlife Service
USGS U.S. Geological Survey
UST Underground Storage Tank
VFZ Vegetation Free Zone
VE Value Engineering
WPC Without Project Condition
WCEL Wadsworth Canal East Levee
WCWL Wadsworth Canal West Levee
WSEL Water Surface Elevation

CHAPTER 1 – INTRODUCTION

1.1 Project Description

The study area is located in Sutter and Butte Counties and is roughly bounded by the Feather River, Sutter Bypass, Wadsworth Canal, Sutter Buttes, and Cherokee Canal. The existing Sutter Basin Levee System (SBLS) consists of four mainline levees : Feather River West Levee (FRWL or right levee), Sutter Bypass East Levee (SBEL or left levee), Wadsworth Canal East Levee (WCEL or left levee) and Wadsworth Canal West Levee (WCWL or right levee), and Cherokee Canal East Levee (CCEL or left levee) surrounding the communities of Yuba City, Live Oak, Gridley, Biggs and other smaller towns in Sutter and Butte Counties, California.

For this Feasibility Study, planning measures were considered and combined to form a preliminary array of conceptual alternatives. Through the plan formulation process, a draft array of eight alternatives were defined as follows:

- Alternative SB-1 – No action alternative (i.e. existing condition)
- Alternative SB-2 – Minimal Fix-in-place Feather River Levees, Sunset Weir to Star Bend

- Alternative SB-3 – Yuba City ring levee
- Alternative SB-4 – Little "J" levee, Thermalito Afterbay to south of Yuba City
- Alternative SB-5 – Fix-in –place Feather River Levees: Thermalito Afterbay to Star Bend
- Alternative SB-6 – Fix-in –place Feather River Levees: Sutter Bypass, and Wadsworth Canal
- Alternative SB-7 – Fix-in –place Feather River Levees: Sunset Weir to Laurel Avenue
- Alternative SB-8 – Fix-in –place Feather River Levees: Thermalito Afterbay to Laurel Avenue

This draft array of alternatives was analyzed and refined to a final array that includes 3 of the alternatives (Alternatives SB-1, SB-7 and SB-8). These final alternatives were further evaluated at a feasibility level of design to verify and determine the Recommended Plan for recommendation. See Plates 1-1 to 1-8 for maps of draft array of alternatives (note that the reach identifications shown in these plates were revised during the final array analysis for Alternatives SB-7 and SB-8 as shown on plate 2-2 and discussed in Paragraph 2.4).

1.2 Purpose and Scope

This Engineering Appendix provides a summary of the engineering analyses performed by the Project Delivery Team (PDT) for the draft and final alternatives, including the existing conditions. The appendix provides narrative descriptions of the final two alternatives. The objective of this appendix (along with referenced subject matter appendices) is to summarize the designs and cost estimates completed for the Feasibility Study.

1.3 Coordination

The Project Delivery Team (PDT) worked closely with the local sponsor comprised of the State of California Central Valley Flood Protection Board (CVFPB) and the Sutter Butte Flood Control Agency (SBFCA) in the preparation of this appendix. The local sponsor's design team includes Peterson Brustad, Inc., HDR, Inc., Wood Rogers, Inc., and MHM, Inc.

SBFCA is a consortium of Sutter and Butte Counties, the Cities of Yuba City, Live Oak, Gridley, and Biggs, and Levee Districts 1 and 9 of Sutter County. The agency was formed in 2007 to finance and construct regional levee improvements. The FRWL Improvement Project's goal is to improve the 44 miles of the right bank levee of the Feather River from the Thermalito Afterbay outlet to the confluence with the Sutter Bypass under a Section 408 permit. The design of the FWRL Improvement Project is being done ahead of the Feasibility Study as an Early Implementation Project (EIP) for future cost share under the Feasibility Study. The SBFCA EIP is at the 100% design level for a portion of the FRWL between Shanghai Bend and Live Oak. The remaining portion of the SBFCA EIP is at the 65% design level.

Additional contacts were also made with local authorities (e.g. the U.S. Fish and Wildlife Service, the United Auburn Indian Community and Enterprise Rancheria etc.) to obtain inputs to the final feasibility design of Alternatives SB-7 and SB-8.

CHAPTER 2 – GENERAL DESIGN CONSIDERATIONS

2.1 General

This chapter summarizes general design considerations used for evaluation of the draft array and final array of alternatives. Refer to the subject matter appendixes for further detail of the analyses. Features resulting from these analyses are provided in project descriptions of Alternatives SB-7 and SB-8, Chapters 4 and 5, respectively.

A key concept of the Pilot Feasibility Study is to utilize an appropriate level of detail to make risk informed decisions. ER 1110-2-1302 Civil Works Cost Engineering describes five levels of detail. The classes are based on ASTM E 2516-06, Standard Classification for Cost Estimate Classification System. The purpose of the classification system is to improve communication among all the stakeholders involved with preparing, evaluating, and using cost estimates (ASTM, 2011). Class definitions, as they relate to the Pilot Study are considered to also describe a level of design and engineering commensurate with the level of detail in the cost engineering classification. These class definitions are described below. Cost accuracies do not necessarily apply to engineering and design but are of a level that is consistent with those accuracies

- Class 5 is the least accurate and is the minimum required for assessing rough order of magnitude. The level of project definition is 0% to 2% of a complete definition. The expected cost accuracy (+/-) is 4 to 20 times the accuracy of the best (Class 1) estimate.

- Class 4 is the minimum required for Reconnaissance/905b Reports and alternative analysis in feasibility studies. The level of project definition is 1% to 15% of a complete definition. The expected cost accuracy (+/-) is 3 to 12 times the accuracy of the best (Class 1) estimate.

- Class 3 is the minimum required for the feasibility NED Plan and Feasibility Sponsor Preferred Plan. The level of project definition is 10% to 40% of a complete definition. The expected cost accuracy (+/-) is 2 to 6 times the accuracy of the best (Class 1) estimate.

- Class 2 is minimum required for Planning, Engineering, and Design up to 90% Plans and Specifications. The level of project definition is 30% to 70% of a complete definition. The expected cost accuracy (+/-) is 1 to 3 times the accuracy of the best (Class 1) estimate.

- Class 1 is minimum required for Planning, Engineering, and Design 100 % Plans and Specifications and the Independent Government Estimate. The level of

project definition is 50% to 100% of a complete definition. This is considered the most accurate estimate. It does not imply that all unknowns and risk are eliminated.

The analysis of the existing condition (i.e. Alternative SB-1) forms the basis of comparison to project alternatives. The analysis of the existing conditions was conducted at a Class 4 level during the screening and selection of the draft array of alternatives. The analysis of the existing condition was refined during the final analysis to a Class 3 level of detail.

Analysis of the draft array of alternatives is based on a Class 4 level of detail. The final array of alternatives (including refinements to the without project conditions) are based on a Class 3 level of detail and is referred to as Final Analysis in this report.

Another key concept in the Pilot Feasibility Study is to utilize existing information where applicable. Since the local sponsor had already completed a 65% design for their Early Implementation Project (EIP) the PDT reviewed and adopted information where applicable (specifically, civil and geotechnical designs, quantity estimates, and utility relocations) All design information was reviewed to ensure it was consistent with the planning objectives of the study. Refer to the Civil and Geotechnical Design Appendixes for the review and adoption of design information in the 65% EIP.

2.2 Datum

The North American Datum of 1983 (NAD 83) State Plane California Coordinate System Zone II (U.S. Survey Feet) was used for horizontal control. The North American Vertical Datum of 1988 (NAVD 88) was used as the vertical datum.

2.3 Alignment and Stationing

2.3.1 General

This section describes the alignment and stationing developed for the Class 4 and Class 3 analyses. Refer to the Civil Design Appendix for further details.

2.3.2 Draft Array of Alternatives SB-1 through SB-8

Alignment stationing were defined for three levee segments during the analysis of the draft array of alternatives. These include: (1) Feather River West Levee or right levee, (2) Sutter Bypass East Levee or left levee, and (3) Wadsworth Canal East Levee or left levee. The project levee alignments were developed based on surveyed data from the National Levee Data Base. The stationing of each levee segment begins with station 0+00 at the intersection with the levee segment at the downstream end, and increases in an upstream direction. See Plate 2-1 for details.

2.3.3 Final Array of Alternatives: SB-7 and Alternative SB-8

For Alternatives, SB-7 and SB-8, the project levee alignment follows the existing levee centerline of the FRWL except at Star Bend where the levee alignment follows the centerline of the setback levee. The stationing begins with station 10+00 at the confluence of the FRWL at the SBEL and increases in an upstream (north) direction. This levee stationing conforms to the existing levee centerline and accounts for recent changes in the alignment, such as the Star Bend Setback Levee (between station 478+68 and station 512+00). At locations where levee relocations (e.g. roughly between station 1432+70 and station 1754+30 etc.) are proposed, supplementary levee alignments stationing necessary for designs and analyses were established. See Plate 2-2 for details.

All tables, figures and plates are shown at the end of this Engineering Report.

2.4 Alternative Reaches

2.4.1 General

This section describes the alternative reaches developed for the analyses of the draft array and final array of alternatives. Refer to the Civil Design Appendix for further details.

2.4.2 Draft Array of Alternatives SB-1 through SB-8

The evaluation of the existing condition (SB-1) and Alternatives SB-2 through SB-8 were based on a 28 reaches (see Plate 2-1). Sixteen of these reaches are existing levee segments. The other 12 reaches are either proposed setback or new (Ring and ”J”) levee segments. Reaches were defined based on similarity in geotechnical and proposed structural fix.

2.4.3 Final Array of Alternatives SB-7 and SB-8

A new reach identification system was developed for the analysis of Alternatives SB-7 and SB-8 (see Plate 2-2). Alternative SB-7 is defined by 21 reaches (2A-North, 2B, 3… 21) starting from station 180+00 (approximately 2,000 linear feet south of Laurel Avenue) and ending at station 1433+83 (immediately north of Sunset Weir). Alternative SB-8 is defined by 41 reaches (2A-North, 2B, and 3 to 41) starting from station 180+00 (approximately 2,000LF south of Laurel Avenue) and ending at station 2368+00 (Thermalito Afterbay). The reaches were also tabulated and shown in Table 4-2 (for Alternative SB-7) and Table 5-2 (for Alternative SB-8). These reaches are a refinement of the reaches in 2.4.2 above based on refinement of the proposed structural fixes.

2.5 Survey Data

2.5.1 General

This section of the report describes the survey data used for this study. Refer to the Civil Design Appendix for further details.

2.5.2 Topographic Data

The project employed topographic information obtained from three sources. LiDAR data acquired in 2008 were obtained from DWR's Central Valley Floodplain Evaluation and Delineation (CVFED) Program and Urban Levee Evaluation (ULE) Program. Topographic data at 2 foot contour intervals were obtained from surveys performed for the USACE during the 2002 Sacramento and San Joaquin Basins Comprehensive Study. The 2002 topography was based on the National Geodetic Vertical Datum of 1929 (NGVD 29). The surveyed data was converted to the North American Vertical Datum of 1988 (NAVD 88) in 2010. The 2010 converted bathymetry was used throughout the study.

Land survey was completed to confirm the LiDAR topographic data. Results show that cross section profiles based on CVFED and ULE Program's LiDAR-based topographic data are comparable with land surveyed elevation.These data sets were used in hydraulic and geotechnical evaluations, site layouts and quantity estimates.

2.5.3 Bathymetric Data

Bathymetry of the Feather River was obtained from a bathymetry survey performed for the USACE during the 2002 Sacramento and San Joaquin Basins Comprehensive Study at a contour interval of 2 feet. The 2002 surveyed elevations were based on the National Geodetic Vertical Datum of 1929 (NGVD 29). The surveyed data was converted to the North American Vertical Datum of 1988 (NAVD 88) in 2010. The 2010 converted bathymetry was used throughout the study.

2.6 Hydrology

2.6.1 General

A hydrologic analysis was completed for the sources of flooding within the study area. The methodology and results are essentially identical for the analysis of the draft array and final array of alternatives.

2.6.2 Hydrologic Analysis
2.6.3 Analysis of Alternatives SB-1 through SB-8

The Wadsworth Canal flood frequency curve was developed from graphical frequency analysis of gage records at Wadsworth Canal near Sutter (DWR stream gage A05929) following Bulletin 17B guidelines.

Flood frequency curves and 30 day balanced hydrographs for Cherokee Canal were developed from gage records at Cherokee Canal near Richvale Gage (DWR stream gage A02984) following Bulletin 17B guidelines. All alternatives except Alternative SB-3 (Yuba City Ring levee) and SB-4 (Little "J" Levee) are based on the existing conditions hydrology.

Hydrology for the Sutter Bypass, Feather River and Butte Basin was based on the Sacramento-San Joaquin Comprehensive study and Lower Feather River Floodplain mapping study. The hydrologic analysis was derived from historical flood events and statistical analysis of

unimpaired or unregulated locations throughout the Sacramento River Basin. Unregulated flows were hydrologically routed through the major reservoirs to develop unregulated and regulated flows at downstream locations. The hydrographs were passed to hydraulic analysis for routing through the flood control system.

Statistical analysis was used to develop curves describing peak unregulated flow versus exceedance probability for seven exceedance events (50, 10, 4, 2, 1, 0.5, and 0.2 percent) throughout the project area. Flow frequency curves showing the unregulated flow frequency are available in the Hydrology Appendix as plates at selected locations throughout the study area. Tables of peak unregulated flows and the period of record, and design flow and peak regulated flow are provided in tables in the Hydrology Appendix. Authorized Design flows and regulated flow–frequency tabular values are shown in the Table 2-1.

2.6.4 Interior Drainage Analysis

An interior drainage analysis was performed only for Alternatives SB-3 and SB-4. An interior drainage analysis was not performed for the other alternatives because analysis of the floodplains indicated it was not a factor in the evaluation and comparison of draft alternatives would have similar hydrology as existing conditions except the for the interior drainage area. Rainfall depths were extracted from the design rainfall analysis. The analysis is based on rainfall depth-area-duration statistics. The runoff area within the alternatives was estimated from topographic mapping. The loss rate coefficient was calibrated to match the peak flows shown the West Yuba City master drainage study. A mean daily flow rate of 918 cfs was estimated for the 24.2 square mile area inside the levee using a 1-day, 10% ACE precipitation volume of 2.82 inches, and a rainfall-runoff coefficient of 0.5.

2.6.5 Final Analysis of Alternatives SB-7 and SB-8

The hydrologic analysis performed for the draft array of alternatives was adopted for use in the analysis of the final array of alternatives for Wadsworth Canal, Cherokee Canal, Feather River, and Sutter Bypass. However, a more detailed interior drainage analysis was performed to evaluate residual flooding. The analysis was performed by Peterson-Brustad Incorporated (PBI) for the Sutter Butte Flood Control Agency (SBFCA). The interior drainage analysis evaluated rainfall runoff and flood depths for 2% (1/50) ACE, 1% (1/100) ACE, 0.5% (1/200) ACE flood events. Storm events with 24-hour and 96 hour durations were evaluated.

The analysis utilized an HEC-HMS model to compute sub basin runoff and a FLO-2D two dimensional hydraulic model to route the runoff through the study area. A total of 16 drainage basins covering approximately 340 square miles were identified within the interior drainage boundary. The drainage basins were further divided into a total of 77 sub basins. The model included ten storm water pump stations that pump drainage water into the Feather River or Sutter Bypass. The FLO-2D model uses a 1,000-foot by1,000-foot grid size and includes the main drainage channels throughout the study area as channel elements. The resulting interior

drainage maps were reviewed and adopted for use in this study. Maps showing the residual interior drainage are provided in the Hydraulic Design Appendix.

2.7 Hydraulic Design

2.7.1 General

This section describes general hydraulic design and analysis of the draft array and final array of alternatives. Refer to the Hydraulic Design Appendix for further details.

2.7.2 Draft Array of Alternatives SB-1 through SB-8

Hydraulic analysis was conducted for design of project features and evaluation of each alternative's flood risk performance relative to the existing conditions. Based on a review of historical conditions and proposed actions, the hydrologic and hydraulic conditions in the future are assumed to be the same as existing conditions.

The flood risk performance of each alternative condition (including the existing condition) was evaluated using Risk and Uncertainty methods. Flood risk is defined as the probability of a flood event occurring and the consequences of occurrence. Flood risk was assessed using the USACE FDA (flood damage assessment) model version 1.2.5a (USACE, 2010). The FDA model combines flow-frequency, stage-discharge, geotechnical fragility, and stage-damage relationships to estimate damages. Uncertainty in each relationship is incorporated by assigning uncertainty estimates and applying a Monte Carlo type approach to combine the results.

Flow-frequency, stage discharge, and geotechnical frequency relationships reflect the exterior (probability) side of the risk calculations. Inundation depth and stage-damage relationships reflect the interior (consequence) side of the risk calculations. For the probability side of the risk calculations, the hydraulic model assumptions are based on flows contained to the channel (allowed to overtop without failure). For the consequence side of the risk calculations, the hydraulic model assumptions are based on levee breach failure or simply the depth for natural overbank (non-levee) conditions.

Hydraulic analyses were conducted using five separate hydraulic models that were adapted from existing hydraulic models utilized for studies within the Sacramento Valley. Water surface profiles for Sutter Bypass and Feather River were computed using an HEC-RAS unsteady one-dimensional flow model of the Sacramento River system. Water surface profiles for Wadsworth Canal were computed using an HEC-RAS steady one-dimensional flow model. Water surface profiles for Cherokee Canal were computed using an HEC-RAS unsteady one-dimensional flow model. Water surface elevations for Butte Basin were based on the UNET unsteady model results obtained from the Sacramento-San Joaquin Comprehensive Study. Inundation depths from levee breach simulations were evaluated using a FLO-2D 2-dimensional unsteady flow model of the study area.

The hydraulic design of project features, project performance, and description of residual floodplains for the draft array of alternatives is provided in the Hydraulic Design Appendix.

2.7.3 Final Analysis of Alternatives SB-1, SB-7 and SB-8

The final hydraulic analysis of Alternatives SB-1, SB-7 and SB-8 was based on the same approach as the evaluation of the draft array of alternatives. However, refinements were made to the Wadsworth Canal model and Sutter Bypass and Feather River hydraulic model. The Wadsworth Canal model was refined to include four bridges. The Sutter Bypass and Feather River models were revised to include a diversion weir near Thermalito Afterbay. These refinements were found to have negligible impacts on computed water surface profiles and flood risk assessment.

2.7.3.1 Current Authorization and Requirement

The Authorized Design Water Surface (ADWS) is the 1957 design water surface (DWS). The Authorized Top of Levee (ATOL) is the 1957 ADWS plus 3-foot free board.

2.7.3.2 Design Analysis

Water surface profiles were developed for use in the design of seepage measures, estimation of project performance, and economic risk analysis. The top of levee was not based on a design water surface profile. As required by ER 1105-2-101 Risk Analysis for Flood Damage Reduction Studies, freeboard or similar buffers to account for hydrologic and geotechnical uncertainties are no longer used for levee planning and design. Project performance is to be described by annual exceedance probability (AEP) and long term risk rather than level of protection. A description of the levee performance is provided at key index points in the Flood Reduction Measures (FRM) performance section of the Hydraulics Appendix.

Water surface profiles along the project reach of Alternative SB-7 and Alternative SB-8 were computed using the Sutter Bypass and Feather River HEC-RAS unsteady one-dimensional flow model of the Sacramento River system. The model was calibrated to two historic flood events that occurred in January 1997 and December 2005 - January 2006. Calibration efforts were specifically focused on the Feather River, Sutter Bypass, and Wadsworth Canal. Detailed calibration for all of the other rivers and storage areas within the HEC-RAS model was considered outside of the scope of this study. Manning's roughness values range from 0.031 to 0.07 in the main channel and 0.05 to 0.10 in the overbanks.

Mean water surface profiles were simulated for 50% (1/2) ACE, 10% (1/10) ACE, 4% (1/25) ACE, 2% (1/50) ACE, 1% (1/100) ACE, 0.5% (1/200) ACE, and 0.2% (1/500) flood events.

2.7.3.3 Top of Levee

The levee height will be reconstructed to the existing top of levee elevation or the ATOL elevation (defined in Paragraph 2.7.3.1), whichever is higher. In no cases, will the levee height exceed these profiles. This height was selected through the plan formulation process. The selection of the levee height is described in the feasibility report and the economic appendix.

2.7.3.4 Erosion Protection/Levee Superiority and Resiliency

Levee superiority for a flood risk management system is the increment of levee height added in order to increase the likelihood that an event exceeding the design event will result in controlled flooding at the design overtopping section. To insure controlled flooding, erosion protection features are required in the reach where initial levee overtopping will most likely occur.

Based on hydraulic analysis of the levee crest and water surface profiles, erosion protections features (such as an articulated mat or anchored High Performance Turf Reinforced Mat (HPTRM) etc.) are needed for 1 location within reach 7, the first point of overtopping, and 1 location within reach 23, another initial point of overtopping (see Plate 2-2 for map of project reaches). For the purpose of this study, use of anchored HPTRM was assumed based on Sacramento District's knowledge of its performance history and familiarity with its cost. Other products such as an articulated mat could also be considered. The purpose of these erosion protection features is to increase the resiliency of the initial overtopping sections. The design objective is to increase the flood warning and evacuation time prior to overtopping failure.

2.7.3.5 Interior Drainage

The levee construction, utility improvements and other relocations will temporarily disrupt the storm drain systems; however, it is anticipated that the temporary disruption will not cause any significant impacts to interior drainage of the basin since the levee construction is expected to be within normal construction season (April through October) during which the storm drain systems won't be needed.

The project also includes removal or downsizing of six culverts for Alternative SB-8. Based on a site evaluation conducted by the local sponsors' engineers, it is estimated that interior drainage would not be impacted by the modification of these features. Further detailed analysis is recommended during preconstruction engineering and design (PED).

2.8 Geotechnical Design

2.8.1 General

This section describes general geotechnical considerations for the evaluation of the existing condition and describes the geotechnical design considerations for and recommendations resulting from the Class 4 and Class 3 analyses. Refer to the Geotechnical Design Appendix for further details.

2.8.2 Evaluation of the Existing Condition (Alternative SB-1)

The evaluation of the existing condition followed the conventional method for evaluating the without-project condition during the screening and selection of alternatives. Risk-based geotechnical analyses were performed to evaluate the existing levees. The first-order-second-moment (FOSM) method, as recommended in ETL 1110-2-556, "Risk-Based Analysis in Geotechnical Engineering for Support of Planning Studies" dated 28 May 1999, was followed during the evaluation. In this approach, the uncertainty in performance is taken to be a function of the uncertainty in model parameters. A set of conditional-probability-of-poor-performance versus floodwater-elevation graphs (also known as fragility curves) were developed for the existing levees as related to underseepage piping, stability and judgment. For all levee reaches in the study except one, the underseepage piping performance mode accounts for virtually all of the probability of poor performance, which agrees with the actual performance history of the levees.

The geotechnical analysis of the existing condition was also updated with additional information (e.g. new boring logs etc.) during the Final Analysis (Class 3).

2.8.3 Class 4 Analysis of Alternatives SB-2 through SB-8

The analysis of Alternatives SB-2 through SB-8 followed the parametric approach during the screening and selection of alternatives. The geotechnical recommendations for seepage and stability modification for fix-in-place alternatives and seepage controls for non-fix-in-place alternatives (e.g., new ring levees, setback levees, etc.) were developed based in large part using engineering judgment. The approach assumed that cutoff walls were the primary method for seepage control, and the design of the measures (e.g., length, depth, percentage of reach, etc) was selected using judgment and the principal of most likely minimum and maximum for each value. After identifying a range, an expected mean value was selected. Refer to Figures 2.1 and 2.9 of the Civil Design Appendix for templates of typical modification measures developed for the Class 4 analysis.

2.8.4 Final Analysis (Class 3) of Alternatives SB-7 and SB-8

The Final Analysis (Class 3) of Alternatives SB-7 and SB-8 was based on the conventional design approach for development of feasibility level design (35%; Class 3) using existing subsurface explorations and deterministic seepage and stability analyses. The design considerations and recommendations for the final alternatives are listed below.

2.8.4.1 Current Authorization and Requirement

USACE guidance for levee design requires geotechnical analysis (for seepage and slope stability) to be performed at the 1957 Authorized Design Water Surface (1957 ADWS, defined in Paragraph 2.7.3.1) at a minimum. The Sacramento District's standard practice requires the analyses to also be performed with the water surface at the 1957 Authorized Top of Levee (1957 ATOL, defined in Paragraph 2.7.3.1).

2.8.4.2 Design Analysis

The geotechnical analysis (for seepage and slope stability) for the design of Alternatives SB-7 and SB-8 were based on the geotechnical analysis prepared for the SBFCA EIP (SBFCA EIP was defined in Paragraph 1.3). The geotechnical analysis for the SBFCA EIP was conducted at two water surfaces: (1) the SBFCA EIP's design water surface (not the 1957 ADWS), and (2) the hydraulic top of levee (HTOL).

The SBFCA EIP's design water surface (SBFCA EIP's DWS) is defined as:

- The 0.5% (1/200) ACE for the urban area upstream of station 461+00 (Reaches 5 – 41)
- The 1% (1/100) ACE for the rural area downstream of station 461+00 (Reaches 2A – 5).

The SBFCA EIP's HTOL (SBFCA EIP's HTOL) is defined as the lowest of:

- The SBFCA EIP's DWS plus 3 feet
- The 0.2% (1/500) ACE water surface
- The existing levee crest elevation

In addition, SBFCA's analysis added an extra foot to the EIP's design water surface (SBFCA EIP's DWS + 1 foot) and to the SBFCA EIP's HTOL profiles (SBFCA EIP's HTOL + 1 foot) for SBFCA EIP's geotechnical analysis of the design of modification measures. The additional foot, which originates in DWR's Urban Levee Criteria, increases confidence in the seepage and stability design.

The "SBFCA EIP's DWS + 1 foot" and "HTOL + 1 foot" profiles were determined to be comparable (within a foot) with the "1957 ADWS" and "1957 ATOL" profiles, respectively (see Plate 2-5). The highest of the water surfaces (SBFCA EIP versus authorized) varies by location along the Feather River. The SBFCA EIP geotechnical analysis showed seepage exit gradients and slope stability factors of safety well within USACE criteria; adding an extra foot of water would not change the recommended design modification measures. Therefore, for the purpose of this Feasibility Study, the SBFCA EIP's geotechnical analysis was considered to be adequate for use as the USACE's final geotechnical analysis of Alternatives SB-7 and SB-8.

2.8.4.3 Modification Features

Where the existing levee meets the geotechnical analysis criteria, no modification is needed. Where modification is required, cutoff walls are the primary feature for addressing geotechnical deficiencies of the existing FRWL for the following reasons:

- Cutoff walls are highly effective when constructed correctly.
- Cutoff walls do not require the acquisition of additional permanent real estate.
- Cutoff walls do not require maintenance once constructed (except for monitoring activities).

- Cutoff walls constructed by the conventional open-trench method are cost-comparable to landside berms when the costs of additional permanent real estate and environmental mitigation for landside berms are included.
- Cutoff walls have minimal long-term environmental impact primarily due to their location within the existing levee footprint.

Two primary modification measures of the FRWL were evaluated. In general, the measures were a fully-penetrating soil-bentonite cutoff wall and a partially-penetrating soil bentonite cutoff wall combined with a seepage berm or relief wells. Both measures would include a partial levee degrade to obtain the needed working platform width. (A full levee degrade is proposed where the levee has a severe burrowing rodent infestation or to prevent having to use the more expensive deep soil mixing (DSM) method for cutoff wall construction due to depth). A reach-by-reach cost comparison between the two measures showed a fully-penetrating soil bentonite cutoff wall was the least-cost measure for most reaches. However, site conditions dictated selection of a different measure for some reaches or portions of reaches.

Jet grout cutoff walls are proposed at locations where it is not practical to construct a conventional soil bentonite cutoff wall (i.e. bridges, railroad crossings, and the Yuba City Water Treatment Plant). Seepage berms by themselves are proposed for the northernmost end of the FRWL because a conventional soil bentonite cutoff wall is not constructible through the cobble levee. Partially penetrating cutoff walls combined with seepage berms or relief wells are proposed for the southern end of the FRWL because fully-penetrating cutoff walls would be too deep to be cost-effective. A cutoff wall with levee relocation and a cutoff wall with Sutter Butte Main Canal (SBMC) relocation are proposed for some levee sections along the FRWL (north of Sunset Weir, where the Sutter Butte Main Canal is located adjacent to the landside levee toe) to obtain the required O&M corridors.

The recommended modification measures for Alternatives SB-7 and SB-8 are shown on Plate 2-3.

2.8.4.4 Minimum Levee Template

The minimum levee template criteria obtained from four sources (USACE EM 1110-2-1913, CESPK-ED-G-SOP-EDG-03 (SOP3), DWR Urban Levee Design Criteria, and the Code of California Regulations (Title 23 Division 1) are shown on Plate 2-4. As a levee modification project, the Sacramento District allows a narrower crest width (not less than 15 ft) for existing levees that have improvements constructed to address seepage and stability concerns. The Sacramento District has adopted the following minimum levee template criteria:

- Crest width: 15 feet minimum.
- Landside slope: 2H:1V or flatter.
- Waterside slope: 3H:1V or flatter.
- Landside easement: 15 feet minimum.
- Waterside easement: 15 feet minimum.

2.8.4.5 Levee Fill and Borrow

Type 1, Type 2 and Random fill materials are needed for levee, cutoff wall and seepage berm constructions. Type 1 levee fill material will be used primarily as a clay core for the reconstructed levee above the cutoff wall and for the cutoff wall's soil-bentonite mix. Type 2 levee fill material will be used primarily for shells for the reconstructed levee above the cutoff wall. Random fill will be used primarily for the seepage berm.

Excavated materials from the levee degrade are expected to be reusable for Type 1 and Type 2 fills. Soils meeting the Type 1 fill requirement also meet the Type 2 and Random Fill requirements. Type 2 fill can be used as Random fill. Therefore, type 1 fill could be used as Type 2 and/or Random Fill in case there are shortages of Type 2 or Random Fill. It is expected that borrow materials will be needed for construction of the project. The two primary types of borrow material for the levee and cutoff wall constructions are: Type 1 and Type 2. Source for borrow is discussed in Paragraph 2.10. Specifications for the two material types are as follows:

- Type 1 Levee Fill: USCS classification of CL, SC, or CH and maximum particle size of 2 inches, AND a minimum 35% by weight passing the #200 sieve, maximum liquid limit of 60, plasticity index between 12 and 40.

- Type 2 Levee Fill: Maximum particle size of 2 inches; minimum 12% by weight passing the #200 sieve; maximum liquid limit of 45.

Based on preliminary geotechnical investigations and standard practice, an approximately 20% increase should be applied to the total demand (to account for all material swell, loss and shrinkage during excavation, transportation and placement, respectively) when estimating the borrow amount needed. The approximate percentages of levee degrade suitable for levee fill are shown in Table 2-2.

2.9 Civil Design

2.9.1 General

This section describes general civil design considerations for and recommendations resulting from the Class 4 and Class 3 analysis.

2.9.2 Class 4 Analysis of Alternatives SB-2 through SB-8

The Class 4 civil design analysis of Alternatives SB-2 through SB-8 followed the parametric approach in which site assessments were completed based on existing information and aerial photos, and quantity estimates were completed based on typical design templates from geotechnical design recommendations. Refer to the Civil Design Appendix for further details.

2.9.3 Final Analysis (Class 3) of Alternatives SB-7 and SB-8

The final civil design analysis of Alternatives SB-7 and SB-8 was based on a conventional design approach for development of feasibility level design (35%; Class 3) with detailed site assessments and deterministic analyses for encroachment and utility improvements, and for quantity analysis. The design considerations are listed below. All civil design analysis was based on hydraulic and geotechnical design recommendations provided in Paragraphs 2.7 and 2.8.

2.9.3.1 Embankment Geometry

The primary feature of the project is a cutoff wall which requires reconstruction of the excavated levee embankment. The reconstructed embankment is required to meet the minimum levee template criteria or to match the existing levee prism, whichever is larger (see Paragraph 2.8.4.4). The degraded levee will be reconstructed to the existing top of levee elevation or the 1957 authorized top of levee elevation, whichever is higher (see Paragraph 2.7.3.3).

In general, the existing levee prism of the FRWL currently appears to be larger than the minimum levee template. At some locations, however, the landside slope was damaged and needs to be reconstructed to meet the minimum levee template criteria (see Paragraph 2.8.4.4). Plate G-2 shows the typical section for embankment reconstruction.

An active railroad embankment (Union Pacific Railroad) crosses the levee alignment at approximate station 1130+00. The railroad embankment is about 4 feet lower than the levee. A stop log closure structure will be provided to meet the authorized levee height without causing impacts to the UPRR's operation. This structure will be closed during flood events.

There are three locations along the FRWL alignment, between station 1434+00 and station 1957+00, where the SBMC encroaches into the proposed right-of-way. The levee will be relocated toward the river at these locations (see Paragraph 2.9.3.3). The relocated levee is required to meet the minimum levee template criteria (see Paragraph 2.8.4.4) and levee height requirement (see Paragraph 2.7.4.3).

2.9.3.2 Right-Of-Way (ROW) Requirements

Currently, the existing FRWL's right-of-way (ROW) corridor includes O&M corridors which vary in width along the alignment and are discontinuous for a significant distance at some locations. The minimum levee template criteria require the project levee to have a 15 feet minimum O&M corridor on each side of the levee, along the levee toes (see Paragraph 2.8.4.4). The O&M corridors are necessary for O&M and flood fighting purposes. Therefore, for this feasibility study, additional real estate will be acquired to provide sufficient space for the O&M corridors. Acquiring additional real estate will result in relocation of physical structures (e.g., buildings, canals, etc.) along the alignment (see Paragraph 2.3). Where it is impractical to acquire the additional real estate, the levee will be relocated toward the river (see Paragraph 2.9.3.3).

There will be one exception in regards to the minimum requirement for O&M corridor. The exception covers the area between station 1904+00 and station 1957+00 where the SBMC is

encroaching into the proposed 15ft minimum landside easement. For this area, an existing 10ft minimum natural berm, on the levee's landside slope, will be utilized for O&M purposes without any further actions (see Paragraph 2.9.3.3).

2.9.3.3 Relocations

To meet the minimum ROW requirements as stated above, acquisition of additional real estate is necessary and will require relocations of certain physical structures. Any physical structures falling within the ROW proposed will be considered potential relocations (except for the encroachment of the SBMC). These relocations will be studied in greater detail in the PED phase.

In the case of the SBMC, which encroaches into the proposed ROW at four locations along the FRWL alignment between stations 1430+00 and 1957+00 (Plate 2-3), there were four potential measures considered for each area to address the issue. The measures include: construction of retaining wall in the landside slope, construction of a flood wall, levee relocation, and canal relocation. Each measure was evaluated based on construction cost and impacts.

The proposed measures were also coordinated with the USFWS to obtain their inputs. The flood wall and retaining wall options were eliminated because these structures were deemed to create a substantial barrier for terrestrial wildlife species migration.

Levee relocation was deemed to have the least overall impact and was selected as the primary measure for addressing the issue. The relocated levee is required to meet the minimum levee template criteria (see Paragraph 2.8.4.4) and height requirement (see Paragraph 2.7.3.3). The cutoff wall will be constructed at the centerline of the relocated levee sections.

Canal relocation was selected for a small section along the alignment where the FRWL is too close to the Feather River's main channel to relocate the levee. This option was also selected for a small section of the SBMC near the Sunset Weir Pump Station, around station 1430+00, because it was deemed to be more cost effective than the levee relocation option which requires relocation of the pump station' electrical system.

At one of the four locations where the SBMC encroaches into the proposed ROW, specifically between station 1904+00 and station 1957+00, an existing 10ft minimum natural berm, on the levee's landside slope, will be utilized for O&M purposes without any further actions needed.

2.9.3.4 Encroachments

A comprehensive inventory of all encroachments (utilities, physical structures, and woody vegetation) was completed based on existing data and field investigations. The existing encroachment data came from multiple sources including the CVFPB encroachment list, the USACE Periodic Inspection report, and as-built drawings of various projects located along the FRWL alignment. Field investigations were conducted to validate and improve the existing inventories.

The final encroachment list (Table 4-3 for Alternative SB-7 and Table 5-3 for Alternative SB-8) shows numerous pipelines (both gravity and pressurized lines) and conduits (cables, electrical lines etc.) crossing the existing FRWL embankment. The record also indicates a number of utilities running parallel to the alignment (power poles, irrigation ditches, pipelines etc.), physical structures (public, residential and commercial buildings), and woody vegetation (mature trees) currently located within the proposed ROW. The encroachments were divided into 2 groups:

- Utilities and Physical Structures
- Woody Vegetations

The following Paragraphs outline the approach for addressing levee encroachment issues (see Plate 2-6 for the utility handle chart).

2.9.3.4.1 Utilities and Physical Structures

This group was subdivided into 2 categories: levee prism encroachments and ROW encroachments.

The levee prism encroachments are utility pipelines and conduits running perpendicular to the levee alignment. Most of these pipeline and conduit crossings are either dated and do not comply with the current standard for levee encroachment or will be disrupted/otherwise impacted by levee construction. These pipelines and conduits, therefore, will be removed before the cutoff wall construction begins and replaced after the cutoff wall construction completes with proper pipe materials. Gravity lines (storm drain) will be replaced in-place. Pressurized lines (irrigation and drainage discharge lines, gas pipes, water and sewer lines etc.) and conduits (electrical and communication lines, cables etc.) will be relocated above the 1957 Water Surface Elevation (WSEL) profile or 0.5% (1/200) ACE WSEL profile north of station 461+00, whichever is greater and above the 1957 WSEL profile or 1% (1/100) ACE WSEL profile south of station 461+00, which ever greater. Where it is not feasible to relocate the pressurized pipelines above the intended WSEL (e.g. at Sunset Weir pump station), these pipelines will be replaced in-place. Pipes that are known to be recent installations will remain. All pipelines and conduits crossing the levee alignment will be modified to include positive closure devices and meet the USACE design criteria for levee penetrations in accordance with EM 1110-2-1913. Abandoned pipelines and conduits will be removed. Typical improvement plans for these utility encroachments were developed and shown in Plate G-3.

ROW Encroachments are the utilities and physical structures that are outside of the levee prism but fall within the limits of the proposed ROW (see Paragraph 2.9.3.2). These structures will be relocated outside of the proposed ROW prior to levee and seepage berm constructions.

Temporary bypass systems will be provided to minimize disruption to irrigation and other utility services during the farming season. The utility improvements and relocations will disrupt the storm drain systems; however, it is anticipated that the disruption will not cause any significant impacts to interior drainage of the basin since the levee construction is expected to be

within normal construction season (April through October) during which the storm drain systems won't be needed.

Tables 4-3 and 5-3 provide detailed descriptions of all utilities, encroachments and the proposed improvement for each site within the Alternatives SB-7 and SB-8, respectively.

2.9.3.4.2 Woody Vegetation on Levee

The FRWL currently has mature trees on the both the levee slopes and within 15 feet of both the landside and waterside levee toes, with the majority of the trees being within 15 feet of the toes in some locations. USACE Engineering Technical Letter (ETL) 1110-2-571 (Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures, 10 April 2009) establishes a vegetation-free zone to provide a reliable corridor of access to, and along, levees, floodwalls, embankment dams, and apparent structures, to assure adequate access by personnel and equipment for surveillance, inspection, maintenance, monitoring, and flood-fighting, and to prevent root penetration into the levee that could compromise its structural integrity. It is, therefore, required that the O&M corridors and levee embankment will be free of all woody vegetation in accordance with the Vegetation-Free Zone (VFZ) requirements in the ETL 1110-2-571.

The local sponsor, in their EIP, proposed allowing woody vegetation to temporarily remain within the EIP's ROW and the adoption of a life cycle adaptive management approach to address noncompliant vegetation removal overtime. The Sacramento District's PDT considered two options to address this issue. The first option was to require complete compliance with the ETL by removal of all woody vegetations within the VFZ. The second option was to require removal of all woody vegetation in the upper 2/3 of the waterside levee slope, the entire landside slope, within 15 feet of the landside toe and obtaining a vegetation variance for trees in the lower 1/3 of the waterside slope and within 15 feet of the waterside toe. The estimated cost differential of ETL 1110-2-571 compliance between the options appeared to be within the overall feasibility study cost contingency.

Because there is no significant cost differential, the first option, complete compliance with the ETL 1110-2-571, is the final recommendation (with exceptions to be considered on a case-by-case basis during the design phase).

2.9.3.5 Quantity Estimate

Quantity estimates were completed for levee construction and utility improvements in accordance with ETL 1110-2-573 Construction Cost Estimating Guide for Civil Works and ER 1110-2-1302 Civil Works Cost Engineering.

The quantity estimates were completed on a reach by reach basis. The estimates for levee excavation and backfill took into account the swell and shrinkage factors, respectively, based on the geotechnical design recommendations (see Paragraph 2.8.4.5). The excavation quantities were estimated based on a degrade level placed at half of the levee height. The backfill quantities were estimated based on the recommended levee geometry (see Paragraph 2.9.3.1). Borrow

quantities were estimated based on the total demand and the quantities of reusable levee degrade. A 20% increase was applied to the total demand, defined as the additional backfill quantities needed beyond the reusable levee degrade, to account for all material swell, loss and shrinkage during excavation, transportation and placement, respectively. The quantities of reusable levee degrade were estimated based on the recommended percentages of reusable material (see Paragraph 2.8.4.5). Cutoff wall quantities were estimated separately for each type of cutoff wall (soil bentonite cutoff wall, deep soil mix cutoff wall, and jet grouting cutoff wall).

2.10 Borrow Sites and Disposal Areas

2.10.1 General

This section describe general considerations for borrow and disposal areas for the Class 4 and Class 3 analyses. Refer to the Geotechnical and Civil Design Appendixes for further details.

2.10.2 Class 4 Analysis of Alternatives SB-2 through SB-8

Borrow sites and disposal areas were not specifically identified during the screening and selection of alternatives. For borrow, the general assumption was that suitable borrow materials could be typically found within the basin and that the borrow sites would be within 15-mile to 30-mile radius of the construction sites. It is assumed that borrow would likely become cost prohibitive if not obtained within this distance, primarily due to air quality impacts. A conservative shrinkage factor of 15% was used for estimating borrow quantities.

2.10.3 Final Analysis (Class 3) of Alternatives SB-7 and SB-8

Detailed analyses of borrow sites and disposal areas were completed for the final alternatives. The considerations are detailed below.

2.10.3.1 Borrow Sites

While some of the embankment material removed during levee degrading will be re-used to reconstruct the levee, it is anticipated that borrow materials will be needed to meet the levee fill material specifications. Two primary types of borrow material needed for levee and cutoff wall construction are: Type 1 levee fill, primarily used as a clay core for the reconstructed levee above the cutoff wall and for the soil-bentonite mix, and Type 2 levee fill, primarily used for shells for the reconstructed levee above the cutoff wall. Specifications for the two material types are discussed in Paragraph 2.8.4.5.

There were 13 sites identified as potential borrow areas, five of which were eliminated as a result of a preliminary screening process completed for each of the sites. The screening criteria, detailed in the EIS, include contamination level, and relative location to the levee/seepage berm. The design teams are currently in the process of sampling and testing the sites to ensure they meet material requirements. The borrow sites are shown on Plates 4-3 and 5-3 for Alternatives SB-7 and SB-8, respectively. Sampling and testing is ongoing for these potential borrow sites. It was estimated that the borrow sites can provide up to 1,349,932 cubic yards of Type 1 fill

material, 459,796 cubic yards of Type 2 fill material, and 330,800 cubic yards of Random fill materials.

Alternative SB-8 requires the largest quantity of borrow material. That alternative may require up to 629,810 cubic yards of Type 1fill material, 809,845 cubic yards of Type 2 fill material, and 179,520 cubic yards of Random fill material. The available borrow sites have an abundance of Type 1 and Random Fills and an insufficient quantity of Type 2 fill. Type 1 fill meets the requirements of Type 2 fill, so the excess Type 1 fill will be used to make up the deficiency of Type 2 fill.

2.10.3.2 Solid Waste Disposal Areas

The nearest solid waste facilities to the project area are the Ostrom Landfill (located east of the project site, approximately 30 road miles south of the project Reach 2) and the Neal Road Landfill (located 25 miles north of the project Reach 40).

The 225 acre Class II Ostrum Landfill is permitted to accept the following types of waste: solid waste; waste water treatment sludge; construction debris; food and green waste; some types of contaminated soils; and non-friable asbestos. The landfill has a total maximum permitted capacity of 43,467,230 cubic yards. In 2007, the Ostrum Landfill was reported to have 39,223,000 cubic yards of remaining capacity (90% of total capacity).

The Neal Road Facility is permitted to accept the following types of waste: municipal solid waste, inert industrial waste, demolition materials, special wastes containing nonfriable asbestos; and septage. The landfill has a total maximum permitted capacity of 25,271,900 cubic yards. In June 2011, the Neal Road Landfill was reported to have 20,396,081 cubic yards of remaining capacity (80% of total capacity).

Implementation of Alternative SB-8 may generate up to 813,000 cubic yards of solid waste that would require disposal. Sources of solid waste related to construction activities would include levee material, structural debris from removal of residences and agricultural structures, roadway pavements, and levee material deemed unsuitable for reuse. Using a reasonable estimate for reuse of the solid waste, the required amount for disposal is reduced to about 240,000 cubic yards. Only 8 per cent of the 240,000 cubic yards of solid waste is structural debris that would be wasted at the commercial disposal sites indicated above. This further emphasizes the adequacy of the identified landfills for the project. The other 220,000 cubic yards of solid waste is to be disposed at the borrow sites.

2.11 Construction Access, Haul Routes and Staging Areas

2.11.1 General

This section describes general considerations for hauling and staging activities for the Class 4 and Class 3 analyses.

2.11.2 Class 4 Analysis of Alternatives SB-2 through SB-8

Haul routes and staging areas were not specifically identified during the screening and selection of alternatives. For cost estimating purposes, it was assumed that a typical 15-mile haul distance (30 miles round trip) would be sufficient for estimating hauling efforts from the construction sites to borrow sites and disposal areas. Refer to the Civil Design Appendix for further details.

2.11.3 Final Analysis (Class 3) of Alternatives SB-7 and SB-8

A hauling and staging plan was developed for Alternatives SB-7 and SB-8 during the Final Analysis (Class 3). Plates 4-3 and 5-3 show the hauling and staging plans for the final two Alternatives SB-7 and SB-8. The plans were developed based on the following assumptions from historical/typical USACE cutoff wall construction projects:

- A 1.5-acre staging area is needed every 2,500 linear feet of levee construction.
- A 5-acre staging area is needed every 5 miles of levee construction to accommodate a job trailer and staff parking.
- The haul route will be mainly on existing public roads, from the center of the source (commercial/borrow source) to the center of the construction contract (see Plates 4-3 and 5-3).
- A 15 foot permanent road easement along the landside and water side edge of the project features (see Paragraph 2.8) is sufficient for movement of construction equipments within the construction site.
- The proposed staging areas are close to public roads for easy access and away from active farm lands, orchards and residential homes (where possible) to minimize impacts caused by construction activities.
- Permanent access to the existing levees will remain except where seepage berms are proposed. Access ramps will be constructed at the seepage berm locations to provide new maintenance access.

2.12 Real Estate Requirements

2.12.1 General

This section describes general real estate requirements determined during the Class 4 and Class 3 analyses. Additional details can be found in the Real Estate Appendix.

2.12.2 Class 4 Analysis of Alternatives SB-2 through SB-8

During the screening and selection of alternatives, the Sacramento District’s Engineering Division delineated the project’s footprint and identified properties impacted by the project (refer to the Civil Design Appendix for greater details). Based on this information, Real Estate Division completed the real estate cost estimate for the draft array of alternatives using the parametric approach in which the impacted properties were classified based on land use and each type of

land use was given an empirical unit cost. The preliminary real estate requirements for the levee footprint, O&M corridor, and utility corridor were estimated as fee value only.

2.12.3 Final Analysis (Class 3) of Alternatives SB-7 and SB-8

The real estate estimate for the Final Analysis (Class 3) of Alternatives SB-7 and SB-8 was developed based on the conventional approach for development of feasibility level design. During the Final Analysis, the Real Estate Plan was developed for Alternatives SB-7 and SB-8 in accordance with ER 405-1-12 and based on the footprints delineating project requirements developed by the Sacramento's Engineering Division. The general Land, Easements, Rights-of-way, Relocation and Disposal Areas (LERRD)'s requirements for the Real Estate Plan include: the acquisition of flood protection levee easement, permanent road easement, utility easement, drainage easement, temporary work area easement, borrow easement, and fee title. The basis for different types of acquisition is as follows:

- The flood protection levee easement is required for the construction and operation and maintenance of project features. The easement varies in width and is delineated by the toe of existing levee and seepage berms (within the project's limit), relocated levee segments and new seepage berms.
- A 15 foot permanent road easement along the landside and waterside edge of the flood protection levee easement, at a minimum, is needed for providing maintenance access to and for flood fighting purposes along the toe of the project features.
- Flood protection levee easement and permanent road easement together will be sufficient to cover the acquisition needed for the vegetation free zone and to allow for the movement of construction equipments within the construction site.
- Additional utility easement (approximately 20ft beyond the permanent road easement for O&M roads) may also be needed for obtaining utility corridors for relocation of utilities parallel to the project's alignment outside of the proposed ROW. This additional utility easement was not specifically identified for the SBFS and will be estimated as percentage of the total utility relocation costs.
- Drainage easement is required for the canal relocations.
- Temporary work area easement is required for acquiring staging areas along the 41 mile long alignment of the project.
- Borrow easement is required for potential borrow sites.
- Potential on-site mitigation areas will be acquired in fee title.

2.13 Environmental Considerations

2.13.1 General

This section describes environmental considerations for the draft and final arrays of alternatives. Refer to the main integrated report for further details.

2.13.2 Evaluation of the Existing Condition (Alternative SB-1)

An inventory and forecast of future without-project conditions was conducted for the study area using existing sources of information for the study area (e.g., county and city general plans, and prior NEPA and CEQA environmental documentation). The results are described in the Sutter Basin Feasibility Study Environmental Without-Project Conditions Report (ICF International, 2012). This report and the EIS/EIR prepared for the SBFCA EIP forms the basis for the "Affected Environment" and "No Action Alternative" sections of the Sutter Pilot Feasibility Study/EIS/EIR. (The SBFCA EIP was defined in Paragraph 1.3 of this report.)

2.13.3 Class 4 Analysis of Alternative SB-2 through SB-8

The screening of alternatives from an environmental standpoint focused on qualitatively assessing temporary and permanent impacts on the environment. The criteria include:

- Assessment of the potential for induced development in the floodplain.
- Minimization of land disturbance outside the existing levee footprint, loss of farmland, impacts to existing structures.
- Minimization and avoidance of adverse effects on air and water quality, sensitive habitat, and other resources.

Information from various data bases and existing reports was used in the evaluation. The primary sources were the Sutter Basin Feasibility Study Environmental Without-Project Conditions Report (ICF International, 2012) and the Environmental Constraints Analysis prepared for the SBFCA EIP (ICF International, August 2011). The results of public involvement, NEPA scoping, and coordination with the resource agencies were also used to assess alternatives.

2.13.4 Final Analysis (Class 3) of Alternatives SB-7 and SB-8

For the Final Analysis (Class 3) of Alternatives SB-7 and SB-8, the study heavily relied on environmental surveys and the Draft EIS/EIR prepared for SBFCA EIP which was released for public review in December 2012. Extensive information developed for the SBFCA EIP's EIS/EIR aided the study in determining environmental impacts and developing mitigation cost estimates. The considerations are detailed below.

2.13.4.1 Significant Impacts

Alternatives SB-7 and SB-8 are anticipated to result in the following significant and unavoidable or potentially significant and unavoidable impacts. The main integrated report discusses these impacts in greater details.

1. Air Quality Impacts

Project construction would result in temporary construction-related emissions. These include:

- Exceedance of applicable thresholds for construction emissions

Emissions would be partially mitigated by reducing vehicle and equipment emissions and implementing a fugitive dust plan. Despite the mitigation measures, the temporary construction emissions are anticipated to be significant and unavoidable.

2. Noise Impacts

Implementation of any of the project alternatives would result in temporary but significant effects related to construction noise and vibration to sensitive receptors near construction areas. These might include:

- Exposure of Sensitive Receptors to Temporary Construction-Related Noise
- Exposure of Sensitive Receptors to Temporary Construction-Related Vibration

Noise-reducing mitigation measures and vibration-reducing construction practices may not be sufficient to reduce the exposure of sensitive receptors to temporary construction noise and vibration to less than significant.

3. Vegetation Impacts

Project construction is estimated to result in permanent impacts to riparian vegetation and wetlands. These might include:

- Disturbance or Removal of Riparian Trees
- Potential Loss of Special-Status Plant Populations Caused by Habitat Loss Resulting from Project Construction

Habitat compensation is proposed to mitigate losses with the goal of no net loss. Mitigation needs for Alternative SB-7 are estimated at 48 acres and for Alternative SB-8 88 acres. For SB-8, a draft mitigation and monitoring plan has been developed which proposes about 88 acres of compensation consisting of about 25 acres at the Star Bend Conservation Area and 63 acres at the proposed Three Rivers Levee Improvement Authorities Feather River Floodway Corridor Restoration Site.

4. **Visual Resources**

Construction potentially could result in significant visual effects in reaches with sensitive viewers. These might include:

- Temporary Visual Effects from Construction.
- Adverse Affects to a Scenic Vista.
- Substantial degradation of the Existing Visual Character or Quality of the Site and its Surroundings.
- Creation of a New Source of Substantial Light or Glare that would Adversely Affect Day and Nighttime Public Views.

The effect mechanisms are primarily vegetation removal and replacement of agricultural and developed land use with seepage berms. Construction activities would also have temporary visual effects.

5. Cultural Resources

Cultural resources are known to exist throughout the planning area. Cultural resources could be disturbed and destroyed under any of the project alternatives. Impacts might include:

- Effects on Identified Archaeological Sites Resulting from Construction of Levee Improvements and Ancillary Features
- Potential to Disturb Unidentified Archaeological Sites
- Potential to Disturb Human Remains
- Direct and Indirect Effects on Identified Historic Architectural/Built Environment Resources Resulting from Construction Activities

While mitigation measures have been identified, the mitigation does not reduce effects to less than significant. The cultural site assessment (CSA) is discussed in greater detail in Paragraph 2.15 of this report.

6. Hazardous, Toxic and Radioactive Wastes (HTRW)

HTRW is discussed in detail in Paragraph 2.14 of this report.

2.13.4.2 Other Impacts

Other environmental impacts are expected due to construction of the proposed Alternatives SB-7 and SB-8. These include:

1. Flood Control and Geomorphic Conditions

Construction of any of the alternatives would be a flood control benefit in the planning area although existing drainage patterns could be altered. Effects on local interior drainage would be mitigated to less than significant by coordinating with owners and operators, preparing drainage studies, and remediating effects through project design.

2. Water Quality and Groundwater Resources

Dewatering of construction areas could result in the release of contaminants to surface or groundwater. This impact would be mitigated to less than significant by implementing provisions for dewatering effluent before it is discharged.

3. Geology, Soils, Seismicity and Mineral Resources

Construction activities associated with any of the alternatives would not result in any significant impacts to geology, soils, seismicity, and mineral resources.

4. Traffic, Transportation and Navigation

Temporary increases in construction-related traffic, temporary road closures, emergency response times, and other traffic, transportation and navigation effects from project implementation were determined to be less than significant under all action alternatives.

5. Climate Change and Greenhouse Gas

Construction activity would cause a temporary and less than significant increase in greenhouse gas emissions.

6. Wildlife

Construction activities could result in potential injury, mortality, or disturbance of special-status and common species, which could affect local populations. Implementation of mitigation measures would minimize or avoid these impacts and bring effects down to a less than a significant level.

7. Fish and Aquatic Resources

No in-water construction is proposed that could directly affect fishery resources. No loss of Shaded Riverine Aquatic cover and critical habitat would occur. Some loss of floodplain riparian vegetation would occur but mitigation is proposed to offset this loss. Thus, the project is not expected to significantly effect fish and aquatic resources.

8. Agriculture, Land Use and Socioeconomics

Project implementation would permanently convert farmland to nonagricultural use where construction extends beyond the existing levee footprint. Overall, the project is intended to preserve existing land use and socioeconomic conditions, especially for agriculture. Additionally, flood control activities are typically considered public uses, which are largely consistent with the land use policies and regulations governing the project area. Construction activities would temporarily increase employment and personal income in the local area.

9. Population, Housing and Environmental Justice

Project implementation of any of the alternatives will require displacement of existing housing units. Permanent acquisition, relocation, and compensation services will be conducted in compliance with Federal and State relocation laws. In cases where project construction is temporarily disruptive to nearby residents, assistance would be provided for residents to relocate temporarily during construction activities and provide compensation to residents for reasonable rent and living expenses incurred as a result of relocation.

The alternatives would not result in disproportionately high and adverse effects on minority populations and low-income populations from acquisition of homes because plenty of vacant homes exist within the affected area to serve as replacement housing.

10. Recreation

The alternatives would not have any permanent effects on recreation in the project area. Temporary access to recreational facilities along the Feather River would be an impact and addressed by providing notification of construction area closures to protect public safety.

11. Utilities and Public Services

Construction of the project may damage drainage and irrigation systems and public utility infrastructure, resulting in temporary disruptions to service. Coordination with drainage and irrigation systems users, consultation with service providers, and implementation of appropriate protection measures would minimize the possibility of any significant effects.

12. Public Health and Environmental Hazards

Project implementation has the potential to slightly increase risks to the public during construction through use of equipment and fuels, but the increased risk is temporary. These risks are minimized by implementation of a stormwater pollution prevention plan and the best management practices (BMPs) it contains to control accelerated erosion, sedimentation, and other pollutants during and after project construction.

2.13.4.3 Environmental Commitments

The following environmental commitments are proposed as part of the project to avoid and minimize construction-related effects.

- Avoidance measures for valley elderberry longhorn beetle.
- Avoidance measures for giant garter snake.
- Avoidance measures for Swainson's hawk.
- Avoidance measures for raptors.
- Measures to minimize loss riparian vegetation.
- Invasive plant species prevention measures.
- Construction limitations near residences.
- Soil borrow site reclamation plan.
- Post-construction operations and maintenance.
- Stormwater pollution prevention plan.
- Bentonite slurry spill contingency plan spill prevention, control and counter-measure plan.
- Monitoring of turbidity in adjacent water bodies.

2.13.4.4 Fish and Wildlife Mitigation Facilities

Mitigation facilities required for fish and wildlife compensation consists of: (1) 24.5 acres at the existing 49-acre Star Bend Conservation Area, located on the west levee of the Feather River, approximately 6 miles south of Yuba City and (2) 63 acres at the proposed Three Rivers Levee Improvement Authorities Feather River Floodway Corridor Restoration Project site located on the opposite east bank of the Feather River. These sites would serve as a valley elderberry longhorn beetle elderberry transplant/compensation site and riparian habitat compensation area for both Alternatives SB-7 and SB-8.

The Star Bend Conservation Area site was created in 2009. LD 1 of Sutter County constructed the Feather River Setback Levee and Habitat Enhancement Project at Star Bend to replace a portion of existing levee that poses a high risk of failure in order to decrease the flood stage, velocity, and scour potential; increase and improve floodplain habitat; and improve habitat connectivity between the Abbot Lake and O'Connor Lakes Units of CDFW's Feather River Wildlife Area. The Star Bend project created approximately 55 acres of floodplain habitat within which to implement mitigation for impacted elderberry and riparian habitat.

For the loss of jurisdictional wetlands and giant garter snake habitat, compensation would be provide by the purchase of credits from local mitigation banks. A detailed mitigation and monitoring plan accompanies the main report in the environmental appendix. The plan describes in greater detail the proposed design for mitigation and monitoring to ensure success.

2.14 Hazardous, Toxic and Radioactive Wastes (HTRW)

2.14.1 General

This section describes HTRW considerations during the Class 4 and Class 3 analyses for the project area.

2.14.2 Class 4 Analysis of Alternatives SB-1 through SB-8

The project area consists of urban, suburban, and rural areas. Potential sources of hazardous materials and waste may exist in the urbanized as well as agricultural areas adjacent to the levees. The following hazardous materials may be present in the project area in a variety of common contexts.

- Pesticides, herbicides, and fertilizers associated with agricultural lands.
- Petroleum hydrocarbons.
- Underground storage tanks.
- Contaminated debris including asbestos.
- Lead associated with paints and structures.
- Wastewater.
- Pits or ponds.
- Stormwater runoff structures.
- Transformers that may contain PCBs.

2.14.2.1 Preliminary Site Assessment

A Preliminary Environmental Site Assessment was conducted by USACE in June–July of 2009. The Preliminary Environmental Site Assessment was conducted to identify recognized environmental conditions, including presence or likely presence of any hazardous substance or petroleum products under conditions that indicate an existing release, a past release, or the material threat of a release into structures, the ground, groundwater, or surface waters of the property. As part of the assessment, a database record search was conducted to identify any known HTRW in the project area. Results of the Preliminary Environmental Site Assessment included:

- 51 registered underground storage tanks and 3 aboveground storage tanks.
- Five sources are listed as small and large generators of U.S. Environmental Protection Agency (EPA)-regulated hazardous waste.
- Five sites that had leaking underground storage tanks, two of which have or had affected public drinking water.
- Six known or potential hazardous substance sites under investigation or cleanup.
- Two waste discharge systems.
- Two landfills.
- 12 suspected drug labs.
- One pesticide-producing facility.

One additional site not included in the Preliminary Environmental Site Assessment was a SuperFund site (Onstott Dusters, Inc.). For the majority of the sources, no records were found to indicate that these potential sources have actually caused major contamination, although investigations are still on-going. Several areas of concern were revealed during the investigation. Most of these areas of concern involve registered underground storage tanks, hazardous waste generators, minor tank leaks, underground storage tank removal and remediation, and accidental releases.

During records research, no known contamination due to HTRW was confirmed within the construction zone. In conclusion, no evidence was found to indicate that any other potential sources of contamination would interfere with any planned construction of the levees. However, implementation of Alternatives SB-7 and SB-8 would potentially result in effects on public health and environmental hazards related to construction activity. These effects are judged to be insignificant when mitigated by various plans and measures to be implemented before construction including Stormwater Pollution and Prevention Plan, Phase I/Phase II Environmental Site Assessment, Toxic Release Contingency Plan, Construction Site Safety Measures, and Emergency Response Plan.

2.14.2.2 Storm Water Pollution Prevention Plan (SWPPP)

Because ground disturbance for the project would be greater than 1 acre, coverage would be obtained under the EPA's National Pollutant Discharge Elimination System (NPDES) general construction activity stormwater permit. The Central Valley Regional Water Quality Control Board administers the NPDES storm water permit program in Sutter and Butte counties. Obtaining coverage under the NPDES general construction activity permit generally requires that the project applicant prepare a stormwater pollution prevention plan (SWPPP) that describes the best management practices that would be implemented to control accelerated erosion,

sedimentation, and other pollutants during and after project construction. The SWPPP would be prepared prior to commencing earth-moving construction activities.

The specific best management practice that would be incorporated into the erosion and sediment control plan and SWPPP would be site-specific and would be prepared by the construction contractor in accordance with the Central Valley Regional Water Quality Control Board Field Manual. However, the plan likely would include one or more of the following standard erosion and sediment control best management practices.

- **Timing of construction**. The construction contractor would conduct all construction activities during the typical construction season to avoid ground disturbance during the rainy season.
- **Staging of construction equipment and materials**. To the extent possible, equipment and materials would be staged in areas that have already been disturbed.
- **Minimize soil and vegetation disturbance**. The construction contractor would minimize ground disturbance and the disturbance/destruction of existing vegetation. This would be accomplished in part through the establishment of designated equipment staging areas, ingress and egress corridors, and equipment exclusion zones prior to the commencement of any grading operations.
- **Stabilize grading spoils**. Grading spoils generated during construction would be temporarily stockpiled in staging areas. Silt fences, fiber rolls, or similar devices would be installed around the base of the temporary stockpiles to intercept runoff and sediment during storm events. If necessary, temporary stockpiles may be covered with an appropriate geotextile to increase protection from wind and water erosion.
- **Install sediment barriers**. The construction contractor may install silt fences, fiber rolls, or similar devices to prevent sediment-laden runoff from leaving the construction area.
- **Stormwater drain inlet protection**. The construction contractor may install silt fences, drop inlet sediment traps, sandbag barriers, and/or other similar devices.
- **Permanent site stabilization**. The construction contractor would install structural and vegetative methods to permanently stabilize all graded or otherwise disturbed areas once construction is complete. Structural methods may include the installation of biodegradable fiber rolls and erosion control blankets. Vegetative methods may involve the application of organic mulch and tackifier and/or the application of an erosion control seed mix. Implementation of a SWPPP would substantially minimize the potential for project-related erosion and associated adverse effects on water quality.

2.14.2.3 Discovery of Potential HTRW Sites During Construction

If any evidence of potential HTRW is found during construction, all work would cease, and USACE would be notified by the contractor for further evaluation of the potential contamination. Any unanticipated hazardous materials encountered during construction would be handled according to applicable Federal, State, and local regulations. USACE would require that a contingency plan that outlines steps to be taken before and during construction activities to document soil conditions, as well as procedures to be followed if unexpected conditions are encountered, be prepared by the contractor. The non-Federal sponsor is responsible for 100 percent of the cost to develop the clean-up procedures (remedial action plan) and to treat the contamination in place or relocate the material (ER 1110-2-1150).

2.14.3 Final Analysis (Class 3) of Alternatives SB-7 and SB-8

The HTRW considerations from the screening and selection of alternatives apply to the Final Analysis (Class 3) of Alternatives of SB-7 and SB-8. A Phase I Environmental Site Assessment of HTRW for Alternative SB-7 or Alternative SB-8 would be complete in PED.

2.15 Cultural Impact Assessment

2.15.1 General

This section describes the CSA during the Class 4 and Class 3 analyses. Refer to the EIS for further details.

2.15.2 Class 4 Analysis of Alternatives SB-1 through SB-8

The cultural resources impacted by the proposed conceptual alternatives were not specifically identified during the screening and selection of alternatives. A statutory level set aside of 1% of the federal share of construction costs (set by the Archeological and Historical Preservation Act of 1974, Public Law 93-271) was applied and used as the cost estimate for the draft array of Alternatives SB-1 through SB-8.

2.15.3 Final Analysis (Class 3) of Alternatives SB-7 and SB-8

The construction of Alternative SB-8 would result in impacts to the levee itself, the Sutter Butte Canal, historic buildings and neighborhoods in Yuba City, other built environment resources identified in the FRWLP EIS/EIR, and several known prehistoric archaeological sites (CA-SUT-5, CA-SUT-10, CA-SUT-20, CA-SUT-77, CA-BUT-52, CA-BUT-53, CA-BUT-496, CA-BUT-1123, and the unnamed site identified by UAIC). The geographically smaller Alternative SB-7 would result in similar impacts, but would avoid the known prehistoric sites in Butte County (CA-BUT-52, CA-BUT-53, CA-BUT-496, CA-BUT-1123).

Additional impacts may be identified as cultural resources inventories are completed, including the borrow areas and utility relocations. These could result in further costs that would be included in the cost estimate developed during PED.

In light of this analysis, USACE will continue to use the 1% of the federal share of construction costs set aside for data recovery of impacted cultural resources as a gross means of estimating cost. USACE would only cost-share the project up to the cost of Alternative SB-7, the Federal costs associated with both alternatives would be the same. Increased cultural resources costs associated with the larger Alternative SB-8 including data-recovery investigations, would be borne by the local sponsor.

2.16 Operation and Maintenance, Repair, Replacement and Rehabilitation (OMRR&R)

2.16.1 General

This section describes the OMRR&R considerations during the Class 4 and Class 3 analyses.

2.16.2 Class 4 Analysis of Alternatives SB-2 through SB-8

OMRR&R related activities were not specifically identified during the screening and selection of alternatives. A brief investigation of OMRR&R costs was done by the local sponsor by soliciting information from various levee districts (LDs) and State maintenance agencies (MAs) within the Sutter Basin. The costs reflect a ratio of base costs to the summation of yearly OMRR&R budgets for the various LDs and MAs. For estimating purposes, the assumed 8.5% of construction cost for OMRR&R related activities for each of the alternatives were deemed to be reasonable.

2.16.3 Final Analysis (Class 3) of Alternatives SB-7 and SB-8

The OMRR&R requirements, activities and costs were identified during the Final Analysis (Class 3) of Alternatives SB-7 and SB-8.

2.16.3.1 General Requirements

The non-Federal sponsors (CVFPB and SBFCA) will be responsible for all OMRR&R related activities upon transfer of the project which will in turn be delegated to the individual levee maintenance authorities. The OMRR&R costs represent average cost to maintain the project improvements throughout the project life. The OMRR&R for flood control features would be performed in accordance with provisions of Title 33, Flood Control Regulation, Maintenance and Operation of Flood Control Work, approved by Secretary of the Army , 9 August 1944, published 17 August 1944, Federal Register. The general intent of the regulations is expressed as follows: “The structures and facilities constructed by the United States for flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.”

USACE’s resident engineer schedules and conducts joint acceptance inspections, monitors correction of deficiencies, schedules and monitors OMRR&R training, ensures that all as-built drawings are complete and accurate, and provides information/support for USACE to prepare and distribute property transfer documentation.

Prior to final acceptance of the project or an increment of the project, pre-final inspections will be conducted on an area-by-area basis or may be conducted on a functional basis. The purpose of these inspections is to ensure transfer of a complete, functional and maintainable project, constructed fully in accordance with contract specifications and drawings. Upon final acceptance of an area or the project, USACE will prepare and transfer an amended OMRR&R manual for the project features and the non-Federal sponsor will assume OMRR&R.

2.16.3.2 Typical OMRR&R Activities

Typical OMRR&R activities both with and without project are considered to be::

- Vegetation removal and control in compliance with Corps of Engineers ETL 1110-2-571, 10 April 2009.
- Rodent control and repair of rodent damage.
- Slope re-grading and reseeding.
- Repair of waterside erosion.
- Maintenance of relief wells and collection ditches.
- Maintenance and repair of flap gates to minimize internal drainage.
- Patrol road/ramp maintenance.
- Inspection/patrolling including participation in Federal and State inspection programs, routine patrolling to identify maintenance needs and to assure flood worthiness, and continuous patrolling during high water conditions.
- Flood fighting
- Closure of the gap in the levee crown for passage of the railroad during high water conditions to prevent flooding of Yuba City and vicinity.

Project implementation will likely result in increased cost /effort for some of these activities and decreased cost/effort for others. Net change in OMRR&R cost/effort is considered to be minimal.

A comparison of the estimated without project O&MRR&R and with project costs in 2012 dollars for the levees to be repaired under Alternatives SB-7 and SB-8 is shown in Table 2-3.

2.16.3.3 Vegetation

The without-project maintenance requirements for vegetation within the project area are not altered by the USACE ETL 1110-2-571. The requirements remain as identified in the Sacramento River Flood Control Project standard manual which states: “clearing of bushes, trees, and other wild growth from the levee crown and slopes. Bushes and small trees may be retained on the waterside slope where desirable for the prevention of erosion and wave wash. Where practicable, measures shall be taken to retard bank erosion by the planting of willows or other suitable growths on areas riverward of the levees.”

Under USACE policy, it is expected that any potential levee project will be required to fully comply with the USACE ETL 1110-2-571, unless a variance is obtained. The USACE ETL 1110-2-571 requires that no vegetation (with the exception of grasses) be allowed to grow within the Vegetation-Free Zone (VFZ), defined in Paragraph 2.9.3.4.2) to assure adequate access by personnel and equipment for surveillance, inspection, maintenance, monitoring, and flood-fighting, and to prevent root penetration into the levee that could compromise its structural integrity.

USACE guidance defines a variance as “alternative vegetation management standards to be applied to a levee system or portion thereof that provide for the same levee functionality as intended in ETL 1110–2–571” (Federal Register, February 17, 2012). Variances may only be granted to allow the preservation of waterside vegetation below the upper third of the waterside

slope. Per the draft variance request procedure published in the Federal Register (February 17, 2012), no variance requests will be approved for noncompliant landside vegetation.

For the case of the Sutter Basin project, it is anticipated that the local sponsor will be seeking a vegetation variance. However, attempting to obtain a variance during the feasibility phase would require substantial time and cost and would be inconsistent with the USACE SMART planning modernization effort. Therefore, the issue of ETL variance will be addressed during the PED phase. Also during the PED phase, further consideration can be given to avoiding and minimizing the removal of vegetation that provides significant habitat for endangered species and other wildlife. Levee design modifications (overbuilding, etc) may be implemented to avoid the loss of trees that are determined regionally significant, such as heritage oak trees. Vegetation outside the construction footprint would be retained if it conforms to established USACE vegetation policy at the time of PED, during detailed design and preparation of construction plans and specifications. Vegetation removal requirements would be based on full compliance with vegetation management guidelines in ETL 1110-2-571, or another approach approved by USACE.

2.17 Cost Engineering

2.17.1 General

This section describes general considerations for the development of the cost estimates during the Class 4 and Class 3 analyses. Refer to the Cost Engineering Appendix for further details.

2.17.2 Class 4 Analysis of Alternatives SB-2 through SB-8

During the screening and selection of alternatives, the cost estimate for Alternatives SB-2 through SB-8 was developed using the parametric approach in which historical and unit costs were employed. The Parametric Cost Estimating MII Toolbox (spreadsheet format) was used to prepare the cost estimate.

2.17.3 Final Analysis (Class 3) of Alternatives SB-7 and SB-8

The cost estimate, prepared by the Sacramento District's Cost Engineering Section, for the final feasibility design of Alternatives SB-7 and SB-8 followed the conventional approach for developing cost estimates for feasibility level design (35%; Class 3). The cost estimate was prepared in accordance with ER 1110-2-1302 and ETL 1110-2-573 for Cost Estimating. The cost estimate was based on the quantity estimates provided by the Sacramento District's Engineering Division (see Paragraph 2.9.3.5 for quantity development). The construction contracts for each of Alternatives, SB-7 and SB-8, were sequenced based on the approximated funding availability and appropriation (see Tables 4-4 and 5-4).

2.18 Value Engineering

2.18.1 General

A combined Value Engineering (VE) Study and Planning Charette was held from 31 October to 4 November 2011. The VE methodology was incorporated into the planning process at an early stage of the study to compare, refine, and optimize alternatives based on multiple criteria. This process also provided an opportunity to validate the array of preliminary alternatives and to ensure that significant alternatives had not been overlooked. The VE Study/Charette was attended by the PDT and non-Federal sponsors, the SPK VE Officer and SPD VE Program Manager, the SPD Plan Formulation Lead, and representatives from the National Pilot Program 17+1 Team.

2.18.2 Methodology

The team reviewed initial alternative evaluation criteria and expanded these criteria based on inputs from the group.The following are the final criteria that were used to assess each alternative in combination with the conceptual level cost estimates for each alternative.

- Life Safety
- Flood Damage Benefits
- Critical Infrastructure Impacts
- Design Capacity Exceedance
- Wise Use of Floodplain
- Sustainability
- Ecosystem Functionality
- Environmental Impacts

Based on the discussions during the combined VE Study and Planning Charette, the team identified alternatives with very similar functions as well as alternatives with little probability of implementation. This resulted in combining and eliminating some of the alternatives as well as refining and optimizing those that were retained by adding or removing measures in order to ensure a robust array. A draft array of potential alternatives was identified for further evaluation.

2.18.3 Results

Following is a summary of the recommendations for the draft array of 8 alternatives to be carried forward for further evaluation.

- Alternative SB-1 – No action alternative (i.e. existing condition)
- Alternative SB-2 – Minimal fix-in-place Feather River Levees, Sunset Weir to Star Bend
- Alternative SB-3 – Yuba City ring levee
- Alternative SB-4 – Little “J” levee, Thermalito Afterbay to South of Yuba City
- Alternative SB-5 – Fix-in –place Feather River Levees: Thermalito Afterbay to Star Bend
- Alternative SB-6 – Fix-in –place Feather River, Sutter Bypass, and Wadsworth Canal Levees

The VE Study and Planning Charette Report, which includes details on the relative ratings of each of the original alternatives and the evaluation process, is included in Appendix B of the Sutter Basin, CA Pilot Study, Progress Document#1 (30 May 2012).

Following the VE study, through additional plan formulation, two additional alternatives were added to the draft array (because the economic net benefit analysis determined that extending the fix-in-place reach further south increased the net benefits), these include:

- Alternative SB-7 – Fix-in-place Feather River Levees: Sunset Weir to Laurel Avenue
- Alternative SB-8 – Fix-in-place Feather River Levees: Thermalito Afterbay to Laurel Avenue

CHAPTER 3 – EXISTING CONDITION

3.1 General

The purpose of this chapter is to provide an overview of the existing levee system delineating the perimeter of the Sutter Basin. The discussion will focus on describing the existing features. Hydraulic and geotechnical analyses of the existing condition and performance of the levee system are discussed in Paragraphs 2.3 and 2.4 of this report. Refer to the Hydraulic and Geotechnical Appendixes for greater details.

3.2 Existing Sutter Basin Levee System

The existing Sutter Basin Levee System (SBLS) consists of four mainline levees which are Feather River West Levee (FRWL), Sutter Bypass East Levee (SBEL), Wadsworth Canal East Levee (WCEL) and Cherokee Canal East Levee (CCEL) surrounding the communities of Yuba City, Live Oak, Gridley, Biggs and other smaller towns in Sutter and Butte Counties, California.

These Local Maintenance Authority (LMA) entities include Levee District (LD) 1 of Sutter County, LD 9 of Sutter County, and California Department of Water Resources Maintenance Areas (MA 3, 7, 13, 16, Wadsworth Canal, and Sutter Bypass). These entities maintain all levees within the study area. Plate 1-1 shows the existing SBLS and LMAs. The levee segments in the study area are as follows:

- Feather River West Levee – MA 3: Right levee (on the west bank) of the Feather River from Project Levee Mile (PLM) 0.00 at the Sutter Bypass confluence upstream to PLM 5.19 at the downstream boundary of the LD 1 segment.

- FRWL – LD 1: Right levee (on the west bank) of the Feather River from PLM 0.00 at the boundary of MA 3 upstream to PLM 16.65 at the downstream boundary of the LD 9 segment.

- FRWL – LD 9: Right levee (on the west bank) of the Feather River from PLM 0.00 at the LD 1 boundary upstream to PLM 6.24 at the downstream boundary of the MA16 segment

- FRWL – MA 16: Right levee (on the west bank) of the Feather River from PLM 0.00 at the LD 9 boundary upstream to PLM 4.09 at the downstream boundary of the MA 7 segment.

- FRWL – MA 7: Right levee (on the west bank) of the Feather River from PLM 0.00 at the MA 16 boundary upstream to PLM 12.07 at the downstream boundary of the Hamilton Bend segment.

- FRWL – Hamilton Bend Area: Right levee (on the west bank) of the Feather River from PLM 0.00 at the MA 7 boundary upstream to PLM 1.20 at the Thermalito Afterbay outlet channel.

- SBEL – Downstream of Wadsworth Canal: Left levee (on the east bank) of the Sutter Bypass from the confluence with the Wadsworth Canal at PLM 4.40 downstream boundary to PLM 22.11 at the confluence with the Feather River.

- SBEL –Upstream of Wadsworth Canal: Left Levee (on the east bank) of the Sutter Bypass from the confluence with the Wadsworth Canal at PLM 4.40 downstream boundary to PLM 0.00.

- WCEL: Left levee (on the south east bank) of the Wadsworth Canal from PLM 0.00 at the confluence with the Sutter Bypass upstream to PLM 4.66 at the East Interceptor Canal.

- WCEL: Right levee (on the north west bank) of the Wadsworth Canal from PLM 0.00 at the Sutter Bypass confluence upstream to PLM 4.66 at the West Interceptor Canal

- CCEL – MA 13: Left levee (on the south east bank) of the Cherokee Canal from PLM 9.90 at the Southern Pacific Railroad Bridge upstream to PLM 6.10 at the Western Canal crossing (this partial segment is not part of the ULE program).

The following Paragraphs provide more details for reach of these levee segments.

3.2.1 Feather River West Levee – MA3

The MA 3 levee segment extends north (upstream) along the right bank of the Feather River from PLM 0.00 at the Sutter Bypass left bank levee to PLM 5.19.

The levee crest elevation varies between 52 feet NAVD88 at the downstream end to 66 feet about half a mile downstream of the upstream end of the segment. The levee height varies between 18 and 26 feet, with an average height of 22 feet. The crest width varies between 20 and 30 feet. The waterside slope varies between 1.6H:1V and 2.5H:1V. The landside slope varies between 1.5H:1V and 3H:1V.

The levee soils consist mostly of alternating layers of silty sand and silt, with lesser amounts of lean clay and sandy clay. The foundation consists of a sandy clay/clay/sandy silt blanket 1 to 50 feet thick. In general, the blanket layer thickness decreases moving upstream along the segment. There is no hardpan within the blanket layer. The underlying pervious layer consists of sand, silty sand, and gravel.

After the 1997 flood, pervious toe drains with overlying stability berms were constructed by USACE between PLM 2.28 and 2.43 (Sacramento River Flood Control Project Phase II Levee Reconstruction, Site 11) and between PLM 3.46 and 3.83 (PL84-99 rehabilitation).

3.2.2 Feather River West Levee – LD 1

The LD 1 segment of the Feather River extends north (upstream) along the right bank of the Feather River from PLM 0.00 at the upstream end of the MA 3 segment to PLM 16.65 at the downstream end of the LD 9 segment. Yuba City is adjacent to the upstream 6 miles of this segment.

The crest elevation varies between 62 feet NAVD88 at the downstream end and 88 feet NAVD88 about 200 feet downstream of the upstream end of the segment. The levee height varies between 19 and 25 feet, with an average height of 22 feet. The crest width varies between 15 and 22 feet. The waterside slope varies between 2H:1V and 3.5H:1V. The landside slope varies between 1.8H:1V and 3.1H:1V. The waterside bench between the levee toe and the riverbank varies from about 30 to 4,500 feet wide.

The levee soils consist of sandy silt, sandy clay, and clay with occasional zones of silty sand downstream of Star Bend (PLM 0.00 to 5.7) and sand, silty sand, and clayey sand with some zones of sandy silt and sandy clay upstream of Star Bend. The foundation soils are highly variable and consist of a clay, sandy clay and sandy silt blanket between 2 and 62 feet in thickness. Occasional, discontinuous zones of the blanket are cemented into hardpan. The blanket layer overlies a sand and gravel pervious layer that is up to 45 feet thick.

Relief wells were installed by USACE in 1955-1957. The City of Yuba City installed additional relief wells between the old relief wells in the southern portion of the relief well area in 1991. USACE installed new relief wells between the original relief wells in the northern portion of the relief well area in 2000. The Shanghai Bend setback levee with a 25-foot deep cutoff wall through the foundation was constructed by USACE after the 1997 flood under a PL84-99 action. A permanent stability berm was constructed by LD 1 after the 1986 flood (approximate PLM 14.00 to 15.5). After the 1997 flood USACE constructed a cutoff wall 40 to 55 feet deep between PLM 12.76 and 14.54. Riprap protection was installed near the Fifth Street Bridge in Yuba City (PLM 14.27 to 14.57) after the 1997 flood. USACE installed relief wells just north of Star Bend (PLM 4.56 to 5.42) after the 1997 flood. LD 1 constructed a setback levee with a 40 to 65-foot deep soil-bentonite cutoff wall through the foundation in 2008 at Star Bend (PLM 3.76 to 4.58). The without–project-condition assumes Star Bend setback levee was not constructed. At PLM 1.5, USACE constructed a stability berm under a PL84-99 rehabilitation action after the 1997 flood.

3.2.3 Feather River West Levee – LD 9

The LD 9 segment extends north (upstream) along the right bank of the Feather River from PLM 0.00 at the upstream end of the LD 1 segment to PLM 6.24 at the downstream end of the MA 16 segment.

The levee crest elevation varies between 83 feet NAVD88 at the downstream end and 91 feet NAVD88 near the upstream end of the segment. The levee height varies between 11 and 21 feet, with an average height of 19 feet. The crest width varies between 16 and 25 feet. The waterside slope varies between 1.9H:1V and 3H:1V. The landside slope varies between 1.4H:1V and 2.6H:1V. The SBMC (about 30 feet wide at the bottom and between 5 and 8 feet deep) is adjacent to the landside levee toe over a portion of this segment. Smaller, localized drainage ditches are at the landside levee toe in some areas where the SBMC is not adjacent to the toe. Width of the waterside bench between the levee toe and the riverbank varies between 5 and 3,800 feet.

The levee soils consist of silt, sandy silt, and sandy lean clay with occasional silty sand. The clay soils predominate at the downstream end of the segment and the silty and sandy soils predominate towards the upstream end of the segment. The foundation soils consist of a sandy clay/sandy silt blanket of variable thickness (average thickness 12 feet), sometimes cemented into a hardpan, overlying a sand/silty sand pervious layer. The pervious layer has some gravel lenses in the downstream half of the segment.

An active railroad embankment crosses the levee alignment at the LD1/LD 9 boundary. The railroad embankment is about 4 feet lower than the levee. This opening is sandbagged during flood events. Trench drains were placed at the landside levee toe between PLM 3.0 and 3.83 and between PLM 4.33 and 4.9 by LD 9 in 1992. The trenches were 4-5 feet deep and 2 feet wide and consisted of a geotextile lining around drain rock, with a perforated PVC pipe near the bottom of the trench. USACE constructed a toe drain with a concrete V-ditch collector between PLM 2.43 and 2.59 in 1998.

3.2.4 Feather River West Levee – MA 16

The MA 16 segment extends north (upstream) along the right bank of the Feather River from PLM 0.00 at the upstream end of the LD 9 segment to PLM 4.09 at the downstream end of the MA 7 segment.

The levee crest elevation varies between 91 feet NAVD88 at the downstream end to 96 feet NAVD at the upstream end. The levee height varies between 7 and 14 feet, with an average height of 10 feet. The crest width varies between 15 and 25 feet. The waterside slope varies between 1.9H:1V and 3.2H:1V. The landside slope varies between 1.3H:1V and 3H:1V. The SBMC is adjacent to the landside levee toe over a portion of this segment. The waterside bench between the levee toe and the riverbank varies between 30 and 3,100 feet wide.

The levee soils consist mostly of sandy silt, with some zones of sandy clay. The foundation consists of a clay/sandy silt blanket, at some locations cemented into hardpan, between 0 and 50 feet thick (average thickness about 20 feet) overlying a pervious sand layer. The pervious layer contains gravel in the upstream half of the segment.

3.2.5 Feather River West Levee – MA 7

The MA 7 segment extends north (upstream) along the right bank of the Feather River from PLM 0.00 at the upstream end of the MA 16 segment to PLM 12.07 at the downstream end of the Hamilton Bend segment.

The levee crest elevation varies between 96 feet NAVD88 at the downstream end and 135 feet NAVD88 at the upstream end. The levee height varies between 5 and 22 feet, with an average height of 15 feet. The crest width varies between 15 and 25 feet. The waterside slope varies between 1.9H:1V and 3.2H:1V. The landside slope varies between 1.3H:1V and 3H:1V. The SBMC is adjacent to the landside levee toe over a portion of this segment. The waterside bench between the levee toe and the riverbank varies between 5 and 4,800 feet wide.

The levee soils consist mostly of sandy silt, with some zones of sandy clay and occasional lenses of sand. The foundation consists of a blanket of clay/sandy clay in the southern portion of the segment and silt/silty sand in the northern portion of the segment. Thickness of the blanket varies between 0 and greater than 80 feet; the average thickness is about 15 feet, and in general the thickness decreases moving upstream along the segment. The pervious layer consists of sand and gravel. The pervious layer is almost entirely gravel upstream of PLM 3.2. Dredge tailings, consisting primarily of cobbles and gravel, have been placed on the waterside bench over the upstream 4 miles of the segment.

USACE constructed a 50-foot deep cutoff wall between PLM 2.68 and 2.82 after the 1986 flood.

3.2.6 Feather River West Levee – Hamilton Bend Area

The Hamilton Bend segment extends north (upstream) along the right bank of the Feather River from PLM 0.00 at the upstream end of the MA 7 segment to PLM 1.20 at the Thermalito Afterbay outlet channel.

The levee crest elevation varies between 134 feet NAVD88 at the downstream end and 139 feet NAVD88 at the upstream end. The levee height varies between 3 and 24 feet, with an average height of 14 feet. The crest width is 15-20 feet upstream of the headgate structure and 60-70 feet downstream of the headgate structure. The waterside slope varies between 2H:1V and 2.5H:1V. The landside slope varies between 1.5H:1V and 3H:1V. The waterside bench between the levee toe and the riverbank varies between 50 and 1,100 feet wide.

The levee is constructed of clay upstream of the headgate structure and silty sand, gravel, and cobbles (dredge tailings) downstream of the headgate structure. There is a thin clay blanket underlying less than half of this levee segment. The pervious layer consists of silty sand, gravel, and cobbles (dredge tailings) about 80 feet thick. The downstream 0.8 miles of the segment was built through dredge tailings piles. The dredge tailings consist of silty sand, gravel, and cobbles and are higher than the levee crest elevation at some locations.

The SBMC crosses the levee alignment at PLM 1.05-1.06. A concrete headgate structure was built across the canal alignment. The headgate structure is 36 feet tall, 50 feet long, and 13.5 feet wide. The headgate structure was abandoned after construction of the upstream Oroville Dam in 1968. The SBMC headgate structure's crest elevation is lower than the crest elevation of the adjacent levee.

3.2.7 Sutter Bypass East Levee

3.2.7.1 Downstream of Wadsworth Canal

The Sutter Bypass levee extends from the confluence with the Wadsworth Canal left bank levee at PLM 4.4 to the south (downstream) along the left bank of the Sutter Bypass to the confluence with the Feather River right bank levee at PLM 22.12.

The levee crest elevation varies from 52 feet NAVD88 at the downstream end to 60 feet NAVD88 at the upstream end. The levee height varies between 14 and 22 feet with an average height of 19 feet. The crest width varies between 17 and 30 feet. The waterside slope varies between 3H:1V and 4H:1V and the landside slope varies between 2.7H:1V and 4H:1V.

The levee soils consist mostly of lean and fat clays with occasional lenses of silt, sand, and silty sand up to 4 feet thick. Subsurface soil conditions are variable over the Bypass alignment, due to the geomorphology of the levee alignment cutting across numerous historic small drainage channels at approximately 90 degree angles. The foundation consists of a clay blanket 10-60 feet thick, with the layer thickness generally lower towards the downstream end of the segment. A portion of the clay blanket is cemented at some locations, locally called "hardpan". There are pockets of sand and silty sand within the clay blanket, varying between 4 and 20 feet thick. The top of some of these pockets is 6 feet below the top of the impervious blanket layer. A widespread sand, silty sand, and gravel layer is underneath the clay blanket.

There is a 1-foot high, 50-foot wide berm at the landside levee toe, with a drainage ditch located at the toe of the berm over most of this segment. In addition, in this area USACE has previously constructed:

- A 2-foot wide, 15-foot deep toe drain trench between PLM 5.4 and 13 (McClatchy Road to Gilsizer Slough) after the 1958 flood.

- A pervious toe drain and overlying stability berm between PLM 12.7 and 14.6 (Gilsizer Slough to Everglade Road) after the 1986 flood.

- A toe drain trench and berm between PLM 4.4 and 5.4 (Wadsworth Canal to McClatchy Road) after the 1997 flood.

- A 2-foot wide, 5-foot deep pervious toe trench with an overlying stability berm at PLM 17.6 in 2001.

- A pervious vertical drain in an abandoned railroad embankment on the landside of the levee between PLM 21.88 and 22.07 (Feather River confluence to 1,000 feet upstream) in 2001.

3.2.7.2 Upstream of Wadsworth Canal

This levee segment extends along the right bank of the Sutter Bypass from PLM 0.00 at high ground at the Sutter Buttes to the southeast (downstream) to the confluence of the right bank levee of the Wadsworth Canal at PLM 4.31.

The levee height varies between 15 feet at the upstream end and 23 feet at the downstream end. The crest width is 20 feet. The waterside slope varies between 3.5H:1V and 4H:1V and the landside slope varies between 2.5H:1V to 3H:1V.

There are no existing soil explorations on this levee segment

A project pump plant at PLM 2.7 pumps interior drainage water over the levee into the Bypass There is also a drainage canal on the landside of the levee. The canal is located 15 to 50 feet from the landside toe and is about 5 feet deep and 12 feet wide at the bottom. USACE constructed a pervious toe drain and overlying stability berm between PLM 3.7 to 4.3 after the 1997 flood.

3.2.8 Wadsworth Canal Levees

3.2.8.1 East (Left) Levee

The left levee of the Wadsworth Canal extends to the northeast (upstream) from PLM 0.00 at the confluence with the Sutter Bypass to PLM 4.66 at the East Interceptor Canal.

The levee crest elevation varies between 60 feet NAVD88 at the downstream end to 65 feet NAVD88 at the upstream end. The levee height varies between 6 feet at the upstream end and 26 feet at the downstream end. The crest width varies between 12 feet at the upstream end and 27 feet at the downstream end. The waterside slope varies between 3H:1V and 3.5H:1V. The landside slope varies between 2H:1V and 2.5H:1V. There is a relatively flat bench 10 to 35 feet wide between the waterside levee toe and the excavated canal sideslopes.

The levee soils consist of interbedded lean clay, fat clay, sand, and silty sand. Sand and silty sand are the dominant soils over the downstream 1.4 miles of the levee segment. Clay soils dominate in the upstream 3.3 miles of the levee. The levee is founded on Basin deposits, generally 4 to 9 feet thick, consisting mostly of lean and fat clay with occasional lenses of silt

and sand. The Modesto Formation underlies the Basin deposits. The upper contact of the Modesto Formation is characterized by very stiff to hard clays, called "hardpan" locally. Below the hardpan, the Modesto Formation consists of silt, lean clay, and fat clay, with 1 to 9 foot thick layers of sand and silty sand.

USACE constructed a soil-cement-bentonite cutoff wall between PLM 0.00 and PLM 0.57 in 2008. The depth of the cutoff wall varied between 42 and 63 feet.

3.2.8.2 West (Right) Levee

This levee segment extends from PLM 0.00 at the confluence with the right bank levee of the Sutter Bypass to the northeast (upstream) along the right bank of the Wadsworth Canal to PLM 4.66 at the West Interceptor Canal.

The levee height varies between 20 feet at the downstream end to 5 feet at the upstream end. The crest width is 10-20 feet. The waterside slope varies between 3H:1V and 3.5H:1V. The landside slope varies between 2H:1V and 2.5H:1V.

There are no known soil explorations in this levee segment. Since the canal is fairly small (about 300 feet from levee crest centerline to levee crest centerline), it is anticipated that soil conditions along the west bank levee would be similar to the left bank levee of the Wadsworth Canal.

A small drainage canal is located at the landside levee toe over most of this segment.

3.2.9 Cherokee Canal East Levee – MA 13

The Cherokee Canal is located in the northwest portion of the project area. The Canal discharges water into the Butte Sink, a low-lying area between the Sacramento River and the Sutter Buttes. The entire canal is 23.1 miles long. The SBFS only includes the left bank levee from PLM 9.90 at the Southern Pacific Railroad bridge to the northeast (upstream) to PLM 6.10 at the Western Canal confluence.

The levee height is 6-10 feet and the crest width is 10-20 feet. The waterside slope varies between 3H:1V and 3.5H:1V and the landside slope varies between 2.5H:1V and 3H:1V.

The levee is constructed of lean and fat clay, silt, and elastic silt. The foundation soils consist of a silt and sandy silt blanket between 3 and 19 feet thick, overlying a pervious layer of silty sand, clayey sand, and clean sand. Where the pervious layer consists of clean sand, it generally contains silt lenses that are 2-4 feet thick.

An irrigation ditch is present at the landside toe.

CHAPTER 4 – ALTERNATIVE SB-7

4.1 General

Alternative SB-7 includes 21 reaches (2A-North to 21) along the FRWL alignment, beginning at station 180+00 (approximately 2,000 feet south of Laurel Avenue) and ending at station 1433+83 (Sunset Weir/Pumping Plant). The levee reaches are shown on Table 4-2 and Plates 2-2 (for Alternative SB-7).

The following Paragraphs describe the project features and measures proposed for this alternative. The proposed project features and measures for this alternative include:

- Soil-Bentonite Cutoff Walls
- Deep Soil Mix Cutoff Walls
- Jet Grouting Cutoff Walls
- Seepage Berms
- Levee Relocations
- Canal Relocations
- Embankment Reconstruction/Landside Toe Fill
- Seepage Interceptor System (Relief Wells, Drain Ditch and Pump Station)
- Erosion Protections
- Closure Structure
- Utility Improvements
- Utility Relocations
- Structural Relocations

These proposed features and measures will rehabilitate, replace, or tie in and function in junction with the existing system. The existing system (see Chapter 3) includes the following features:

- Existing Embankment
- Existing Cutoff Walls
- Existing Stability Berms
- Existing Seepage Interceptor System (Relief Wells, Drain Ditch and Pump Station)
- Existing Relief Wells
- Existing Closure Structures
- Existing Toe Drains

Table 4-1A and 4-1B and Plate 2-3 summarize different combinations of the existing and proposed features for Alternative SB8 along its alignment. See the Engineering Plan drawings for more details.

4.2 Feature Description

This section provides general descriptions for each of the combinations listed in Table 4-1. Refer to Table 4-2 and Plates G-1 and G-2 for levee improvements. Refer to Table 4-3 and Plate G-3 for utility improvements.

4.2.1 No Modification Required

There are 4 levee sections along the FRWL alignment in SB-7 where modification is not required. These sections are between: (1) 831+50 and 844+50, (2) 923+75 and 1006+24, (3) 1007+70 and 1024+00, and (4) 1027+50 and 1078+00, approximately (see Table 4-2 for more details). Existing cutoff walls (30 to 50 feet in depth) are present within the first four levee sections.

4.2.2 Cutoff Wall Only

There are 7 levee sections along the FRWL alignment in SB7 where cutoff wall is the only modification feature required. These sections are between: (1) 231+00 and 453+00, (2) 478+68 and 512+00, (3) 570+00 and 831+50, (4) 1078+00 and 1096+00, (5) 1098+10 and 1107+00, (6) 1125+70 and 1129+99, and (7) 1130+20 and 1429+00, approximately (see Table 4-2 for more details).

4.2.3 Jet Grouting Cutoff Wall Only

There are 3 levee sections along the FRWL alignment in Alternative SB-7 where jet grouting cutoff wall is the only modification feature required. These levee sections are between: (1) 1006+04 and 1007+90, (2) 1095+80 and 1098+30, and (3) 1129+50 and 1130+67, approximately (see Table 4-2 for more details).

4.2.4 Seepage Berm Only

There is 1 levee section along the FRWL alignment in Alternative SB-7 where seepage berm is the only modification feature required. These levee sections are between: (1) 1024+00 and 1027+50, approximately (see Table 4-2 for more details).

4.2.5 Cutoff Wall with Full Levee Degrade and Relief Wells

The levee section between 844+50 and 897+50 along the FRWL alignment will be fully degraded and reconstructed with a cutoff wall along the levee centerline. The proposed cutoff wall will function in combination with the existing seepage interceptor system (including 52 relief wells, drain ditch and pump stations).

4.2.6 Cutoff Wall with Relief Wells

A cutoff wall is required for the area between station 512+00 and station 570+00. The proposed cutoff wall will function in combination with the existing seepage interceptor system (including 24 relief wells, A drainage ditch, and pump stations) between station 512+00 and station 545+00. New seepage collector system (including 22 relief wells and a 2,500-foot long concrete lined V-ditch) will be installed between station 545+00 and station 570+00 at 120-foot interval. The new seepage interceptor system will be tied in with the existing one at station 545+00.

A cutoff wall is also required for the area between station 897+50 and station 923+75. The proposed cutoff wall will function in combination with the existing seepage interceptor system (including 24 relief wells, drain ditch and pump stations).

4.2.7 Cutoff Wall with Seepage Berm

There are 2 levee sections where both a cutoff wall and a seepage berm are required. These levee sections are approximately between: (1) 180+00 and 231+00, and (2) 453+00 and 478+68 (see Table 4-2 for more details).

4.2.8 Cutoff Wall with Levee Relocation

None of the levee sections within the limit of Alternative SB-7 requires levee relocation.

4.2.9 Cutoff Wall with Canal Relocation

The SBMC will be relocated away from the existing levee toe between 1429+00 and 1432+70. The existing canal section will be backfilled. A cutoff wall is required at this location and will be constructed along the levee centerline.

4.2.10 Cutoff Wall with Landside Toe Fill

Cutoff wall is required for the area between 1107+00 and 1125+70. The landside toe depression in this area will be filled.

4.2.11 Soil- Bentonite versus Deep Soil Mix (DSM) Cutoff Wall

The proposed cutoff walls vary in depth along the project alignment. At locations where a cutoff wall is required (except for the jet grouting sites), the cutoff wall will be: soil bentonite cutoff wall (if the wall is less than 75 feet in depth) or DSM cutoff wall (if the wall is greater than 75 feet in depth). There are 4 levee sections along the FRWL alignment where DSM cutoff walls are required. These sections are between: (1) 230+00 and 250+00, (2) 1125+00 and 1129+99, (3) 1130+20 and 1151+50, and (4) 1224+00 and 1248+00, approximately (see Table 4-2 for more details). The wall's depth at these locations varies between 75 and 120 feet. Between 844+50 and 897+50, an 85-foot deep soil bentonite cutoff wall is considered adequate for this area.

4.2.12 Erosion Protection

An anchored HPTRM is required on the landside slope for the initial overtopping section located in reach 7 between 547+00 and 604+60 in order to increase the sections resiliency and enhance flood warning and evacuation time prior to overtopping failure from events that exceed the design event.

4.2.13 Closure Structure

Stop log closure structure or equivalent is required at station 1130+00, where the UPRR crosses the FRWL alignment.

4.2.14 Modification of Existing Utilities and Encroachments

Table 4-4B summarizes the number of utilities and encroachments to be modified by construction of Alternative SB-7. A total of 123 utility/encroachment items will be removed, modified (to meet the USACE standard for levee penetrations) or relocated outside of the proposed ROW. Refer to Table 4-3 for more detailed descriptions.

4.3 Environmental Mitigation Measures

The main report described in detail mitigation measures to avoid, minimize and compensate for environmental impacts.

A Mitigation and Monitoring Plan accompanies the main report in the environmental appendix (Appendix D). For direct effects on woody riparian trees that cannot be avoided, compensation is proposed for the loss of riparian habitat to ensure no net loss of habitat functions and values. For elderberry shrubs and riparian habitat, about 48 acres of mitigation acreage would be established at the Star Bend Conservation Area and the TRLIA Feather River Floodway Corridor Restoration Site.

4.4 Cultural Mitigation Measures

USACE negotiated a programmatic agreement (PA) with the California State Historic Preservation Officer (SHPO) that outlines the specific processes that USACE will follow to identify and treat cultural resources. The PA took effect after it was signed by USACE and the SHPO on June 8, 2012, and was subsequently transmitted to the Advisory Council on Historic Preservation.

Following the terms of the PA, before construction begins, the following will occur:

- USACE and the SHPO would formally agree upon a final area of potential effect (APE) for the project. The APE comprises the entirety of the area where cultural resources could potentially be affected by the project.
- USACE, in consultation with the SHPO, would fully inventory the APE for cultural resources. This inventory would include both the pedestrian survey efforts conducted to date by ICF, as well as subsurface prospection efforts.
- In consultation with the SHPO, USACE would evaluate all cultural resources in the APE for their eligibility for listing in the National Register of Historic Places (NRHP). Work necessary for these evaluations may include detailed recordation, background research, and test excavation.

- USACE; in consultation with the SHPO, the public, interested Native American Tribes, or other identified stakeholders; would provide adequate mitigation to resolve any adverse effects to NRHP eligible cultural resources (historic properties).

Alternative SB-7 is a subset of Alternative SB-8 and would impact fewer cultural resources. Based on available information, it is possible to anticipate that construction of Alternative SB-7 could affect known cultural resources including the levee, the historic buildings and neighborhoods in Yuba City, other built environment resources identified in the FRWLP 408 EIS/EIR, and several prehistoric archaeological sites (CA-SUT-5, CA-SUT-10, CA-SUT-20, CA-SUT-77, and the unnamed site identified by UAIC). USACE would follow the processes outlined in the PA to resolve adverse effects to these resources.

Proposed borrow areas have not yet been surveyed. The records and literature search indicates that one of the proposed borrow locations at Star Bend would impact a fourth prehistoric archaeological site, CA-BUT-17. Inventories of the remaining borrow sites, and other sites that may be defined in the future, could result in the identification of more impacts.

Any unknown cultural resources found in the course of further inventory work would be evaluated for NR eligibility, and effects to those resources would be resolved as necessary, following the processes outlined in the PA.

4.5 Borrow, Borrow Sites and Disposal Areas

Type 1, Type 2 and Random fill materials are needed for levee, cutoff wall and seepage berm constructions. Type 1 levee fill material will be used primarily as a clay core for the reconstructed levee above the cutoff wall and for the cutoff wall's soil-bentonite mix. Type 2 levee fill material will be used primarily for shells for the reconstructed levee above the cutoff wall. Random fill is used primarily for seepage berms.

Excavated materials from levee degrade are expected to be reusable for Type 1 and Type 2 fills. Type 1 fill can be used as Type 2 and Random Fill. Type 2 fill can be used as Random fill. It is expected that borrow materials will be needed for construction of the project.

The two primary types of borrow material for the levee and cutoff wall constructions are: Type 1 and Type 2. Specifications for the two material types are as follows:

- Type 1 Levee Fill: USCS classification of CL, SC, or CH and a maximum particle size of 2 inches; minimum 35% by weight passing the #200 sieve; maximum liquid limit of 60; plasticity index between 12 and 40.

- Type 2 Levee Fill: Maximum particle size of 2 inches; minimum 12% by weight passing the #200 sieve; maximum liquid limit of 45.

The borrow areas are sites 5, 7, 8 and 12 shown in Plate 4-3. The source for borrow is discussed in Paragraph 2.10.3.1. A material balance analysis was completed for borrow

quantities based on the preliminary information and the results are shown cubic yards (cy) in Tables 4-5 and 4-6.

Implementation of Alternative SB-7/SB-8 may generate up to 813,000 cubic yards of solid waste that would require disposal. Sources of solid waste related to construction activities would include levee material, structural debris from removal of residences and agricultural structures, roadway pavements, and levee material deemed unsuitable for reuse.

The nearest solid waste facilities to the project area are the Ostrom Landfill (located east of the project site, approximately 30 road miles from the southern end of the project at Reach 2) and the Neal Road Landfill (located 25 miles north of the project Reach 40).

Assuming all of the estimated 813,000 cubic yards of waste material would require permanent disposal, Alternative SB7/SB8 implementation would represent 2% of the Ostrom Road Landfill and 4% of the Neal Road Landfill remaining capacities. However, the option of beneficial reuse is likely to reduce the cubic yards of soil that require permanent disposal as discussed in paragraph 2.10.3.2 above.

4.6 Construction Access, Haul Routes and Staging Areas

Haul route will be mainly on existing public roads (see Plate 4-3).

4.7 Real Estate Requirements

A total of 27 physical structures fall within the proposed ROW and, therefore, will be demolished for construction of this alternative. All of these structures are within reach 16 (Yuba City).

Approximately 2,110 acres will be acquired and 292 parcels will be impacted (refer to the Real Estate Appendix for more details).

4.8 Operation and Maintenance, Repair, Replacement and Rehabilitation (OMRR&R)

4.8.1 Flood Damage Reduction Features

OMRR&R activities for flood control works are generally the same with and without the project. However the cost and effort associated with each activity may increase or decrease as a result of the project. These increases or decreases are considered to be roughly offsetting and net change in overall OMRR&R effort is judged to be insignificant. Expected impacts of the project on these activities are as follows:

1. Construction activities including reconstruction of the upper half of the levee, regarding of side slopes vegetation removal, rodent disruption and crown road reestablishment will reduce maintenance costs in the short term.

2. Vegetation removal/control. For the purpose of this feasibility study it is assumed that, absent the project, the State will gradually bring levees into compliance with USACE ETL 1110-2-571 using a life cycle approach to vegetation management. Under this assumption, the immediate compliance with the ETL required by the project will result in an interim increase in cost and effort required for vegetation removal and control which will be offset initially by clearing during construction. Net increase in OMRR&R cost is anticipated.

3. Rodent control/damage repair. Increase in embankment volume resulting from the addition of seepage and stability berms could result in a slight increase in rodent related maintenance activity.

4. Slope maintenance. Reduction in OMRR&R will occur due to reduction in seepage. The VFZ required by USACE ETL 1110-2-571 the project area will reduce the need for periodic levee toe regrading previously caused by farming operations.

5. Repair of waterside erosion. No additions or significant changes to erosion are anticipated.

6. Maintenance of relief wells and collection ditches. Relief wells north of Shanghai Bend will be converted to observation wells due to slurry wall taking over seepage control function. These actions result in a net reduction in OMRR&R effort.

7. Maintenance and repair of flap gates and closure structures to minimize internal drainage. A stop log closure structure for the railroad crossing at SBFCA station 1130+47, reach 17 is a project feature added to prevent over topping at this location. This accomplished without the project by sandbagging. The stop log structure will significantly reduce the effort to close this gap. However, it remains a flood control feature that requires human intervention to implement. This structure must remain functional to prevent flooding of Yuba City and vicinity.

8. Encroachments. Wet penetration encroachments will be improved or eliminated all along the length of the project. Dry encroachments, such as power poles and vegetation will be reduced. Result will be a decrease in OMRR&R costs.

9. Road/ramp maintenance. The addition of an O&M road at the toe of the levee for the entire length of the levee in addition to the existing road on the levee crown will essentially double the cost and effort associated with road maintenance. However, the added road will enhance the efficacy of virtually all OMRR&R activities including inspections, patrolling and flood fighting.

10. Inspection/patrolling including participation in Federal and State inspection programs, routine patrolling to identify maintenance needs and to assure flood worthiness, and continuous patrolling during high water conditions. The added landside O&M toe road will significantly enhance inspection and patrolling activities.

11. Flood fighting. The project flood control features (seepage berms, stability berms, and cutoff walls) are intended to eliminate seepage and stability issues during high water. The added

O&M road at the landside levee toe should dramatically improve identification of any issues that may develop during high water and facilitate their rapid repair.

4.8.2 Mitigation Features

For Alternative SB-7 an estimated 56 acres are designated for mitigation of habitat loss due to project construction. An estimated 35 acres are available at the Star Bend mitigation site. Additional mitigation needs will be accomplished with additional mitigation sites and/or mitigation bank credits. USACE will enter into a contract to preserve the plantings for a term of three years following completion of construction. At the end of this term the areas will be turned over to the local sponsor who will maintain the areas to accomplish predetermined levels of re-vegetation success targeted for 5 years from planting.

4.8.3 Estimated Annual OMRR&R Cost

The estimated cost of OMRR&R for Alternative SB-7 in 2012 dollars is $ 277,000 as compared to $ 264,000 for the same levee reaches without the project. See Table 2-3.

4.9 Cost Estimate and Construction Schedule

The total first cost for alternative SB-7 is $390,240. The estimated fully funded cost is $438,800. Details are shown in the Cost Engineering Appendix.

The project is divided into 5 construction contracts: A, B, C1, C2 and Star Bend Fix-in-place (SBFIP). Table 4-4 summarizes the extent, year of construction and project features for each of the construction contracts. For more information on construction contracts and their sequencing, refer to the Cost Engineering Appendix.

CHAPTER 5 – ALTERNATIVE SB-8

5.1 General

Alternative SB-8 includes 41 reaches (2A-North to 41) along the FRWL alignment, beginning at station 180+00 (approximately 2,000 feet south of Laurel Avenue) and ending at station 2368+00 (Thermalito Afterbay). The levee reaches are shown on Table 5-2 and Plate 2-2 (for Alternative SB-8).

The following Paragraphs describe the project features and measures proposed for this alternative. The proposed project features and measures for this alternative include:

- Soil-Bentonite Cutoff Walls
- Deep Soil Mix Cutoff Walls
- Jet Grouting Cutoff Walls
- Seepage Berms
- Levee Relocations
- Canal Relocations

- Embankment Reconstruction/Landside Toe Fill
- Seepage Interceptor System (Relief Wells, Drain Ditch and Pump Station)
- Erosion Protections
- Closure Structure
- Utility Improvements
- Utility Relocations
- Structural Relocations

These proposed features and measures will rehabilitate, replace, or tie in and function in junction with the existing system. The existing system (see chapter 3) includes the following features:

- Existing Embankment
- Existing Cutoff Walls
- Existing Stability Berms
- Existing Seepage Interceptor System (Relief Wells, Drain Ditch and Pump Station)
- Existing Relief Wells
- Existing Closure Structures
- Existing Toe Drains

Table 5-1A and 5-1B and Plate 2-3 summarize different combinations of the existing and proposed features for Alternative SB-8 along its alignment. See the engineering plan drawings for more details.

5.2 Feature Descriptions

This section provides general descriptions for each of the combinations listed in Table 5-1. Refer to Table 5-2 and Plates G-1 and G-2 for levee improvements. Refer to Table 5-3 and Plate G-3 for utility improvements.

5.2.1 No Modification Required

There are 7 levee sections along the FRWL alignment where modification is not required. These sections are between: (1) 831+50 and 844+50, (2) 923+75 and 1006+24, (3) 1007+70 and 1024+00, (4) 1027+50 and 1078+00, (5) 1625+00 and 1673+00, (6) 1769+40 and 1813+30, and (7) 2303+00 and 2331+00, approximately (see Table 5-2 for more details). Existing cutoff walls (30 to 50 feet in depth) are present within the first four levee sections.

5.2.2 Cutoff Wall Only

There are 14 levee sections along the FRWL alignment where cutoff wall is the only modification feature required. These sections are between: (1) 231+00 and 453+00, (2) 478+68 and 512+00, (3) 570+00 and 831+50, (4) 1078+00 and 1096+00, (5) 1098+10 and 1107+00, (6) 1125+70 and 1129+99, (7) 1130+20 and 1429+00, (8) 1451+50 and 1455+00, (9) 1461+00 and 1608+50, (10) 1624+70 and 1625+00, (11) 1673+00 and 1673+30, (12) 1766+00 and 1769+40,

(13) 1813+30 and 1900+50, and (14) 1903+50 and 2290+00, approximately (see Table 5-2 for more details).

5.2.3 Jet Grouting Cutoff Wall Only

There are 4 levee sections along the FRWL alignment where jet grouting cutoff wall is the only modification feature required. These levee sections are between: (1) 1006+04 and 1007+90, (2) 1095+80 and 1098+30, (3) 1129+50 and 1130+67, and (4) 1900+00 and 1904+00 approximately (see Table 5-2 for more details).

5.2.4 Seepage Berm Only

There are 3 levee sections along the FRWL alignment where seepage berm is the only modification feature required. These levee sections are between: (1) 1024+00 and 1027+50, (2) 2290+00 and 2303+00, and (3) 2331+00 and 2368+00, approximately (see Table 5-2 for more details).

5.2.5 Cutoff Wall with Full Levee Degrade and Relief Wells

There are 2 levee sections along the FRWL alignment where the levee will be fully degraded and reconstructed with a cutoff wall along the levee centerline These levee sections area between: (1) 844+50 and 897+50, and (2) 1455+00 and 1461+00.

The proposed cutoff wall will function in combination with the existing seepage interceptor system (including 52 relief wells, a drainage ditch and pump stations) between station 844+50 and station 897+50.

5.2.6 Cutoff Wall with Relief Wells

Cutoff wall is required for the area between station 512+00 and station 570+00. The proposed cutoff wall will function in combination with the existing seepage interceptor system (including 24 relief wells, a drainage ditch and pump stations) between station 512+00 and station 545+00. A new seepage collector system (including 22 relief wells and a 2,500-foot long concrete lined V-ditch) will be installed between station 545+00 and station 570+00 at 120-foot interval. The new seepage interceptor system will be tied in with the existing one at station 545+00.

A cutoff wall is also required for the area between station 897+50 and station 923+75. The proposed cutoff wall will function in combination with the existing seepage interceptor system (including 24 relief wells, drain ditch and pump stations).

5.2.7 Cutoff Wall with Seepage Berm

There are 2 levee sections where both a cutoff wall and a seepage berm are required. These levee sections are between: (1) 180+00 and 231+00, and (2) 453+00 and 478+68, approximately (see Table 5-2 for more details).

5.2.8 Cutoff Wall with Levee Relocation

The existing levee will be relocated 20 feet toward the river at three locations, between: (1) 1432+70 and 1451+50, (2) 1608+50 and 1624+70, and (3) 1673+30 and 1754+30. A cutoff wall is required at these locations and will be constructed along the relocated levee alignment.

5.2.9 Cutoff Wall with Canal Relocation

The SBMC will be relocated away from the existing levee toe at two locations: (1) between 1429+00 and 1432+70, and (2) between 1754+30 and 1766+00. The existing canal sections will be backfilled. A cutoff wall is required at these locations and will be constructed along the levee centerline.

5.2.10 Cutoff Wall with Landside Toe Fill

A cutoff wall is required for the area between 1107+00 and 1125+70. The landside toe depression in this area will be filled.

5.2.11 Soil- Bentonite versus Deep Soil Mix (DSM) Cutoff Wall

The proposed cutoff walls vary in depth along the project alignment. At locations where a cutoff wall is the required (except for the jet grouting sites), the cutoff wall will be: soil bentonite cutoff wall (if the wall is less than 75 feet in depth) or DSM cutoff wall (if the wall is greater than 75 feet in depth). There are 10 levee sections along the FRWL alignment where DSM cutoff walls are required. These sections are between: (1) 230+00 and 250+00, (2) 1125+00 and 1129+99, (3) 1130+20 and 1151+50, (4) 1224+00 and 1248+00, (5) 1987+25 and 2002+00, (6) 2016+75 and 2036+75, (7) 2067+00 and 2088+00, (8) 2137+00 and 2148+00, (9) 2182+00 and 2196+50, (10) 2245+75 and 2292+00, approximately (see Table 5-2 for more details). The wall's depth at these locations will vary between 75 and 120 feet. Between 844+50 and 897+50, an 85-foot deep soil bentonite cutoff wall is considered adequate for this area.

5.2.12 Erosion Protection

An anchored HPTRM is required on the landside slope for two initial overtopping levee sections located in reaches 7 and 23 between: (1) 547+00 and 604+60, and (2) 1582+00 and 1601+00 to increase the sections' resiliency and enhance flood warning and evacuation time prior to overtopping failure from events that exceed the design event.

5.2.13 Closure Structure

A stop log closure structure or equivalent is required at station 1130+00, where the UPRR crosses the FRWL alignment.

5.2.14 Modification of Existing Utilities and Encroachments

Table 5-4B summarizes the number of utilities and encroachments to be modified by construction of Alternative SB-8. A total of 223 utility/encroachment items will be removed, modified (to meet the USACE standard for levee penetrations) or relocated outside of the proposed ROW. Refer to able 5-3 for more detailed descriptions.

5.3 Environmental Mitigation Measures

As described for SB-7, the main report described in detail mitigation measures to avoid, minimize and compensate for environmental impacts.

SB-8 would have similar impacts as SB-7 but would result in a greater loss of riparian habitat and impact on listed species. A Mitigation and Monitoring Plan accompanies the main report in the environmental appendix (Appendix D). For direct effects on woody riparian trees that cannot be avoided, compensation is proposed for the loss of riparian habitat to ensure no net loss of habitat functions and values. For elderberry shrubs and riparian habitat, about 88 acres of mitigation acreage would be established at the Star Bend Conservation Area and the TRLIA Feather River Floodway Corridor Restoration Site.

For the loss of jurisdictional wetlands and giant garter snake habitat, compensation would be provide by the purchase of credits from local mitigation banks as described in the Mitigation and Monitoring Plan.

5.4 Cultural Mitigation Measures

USACE negotiated a programmatic agreement (PA) with the California State Historic Preservation Officer (SHPO) that outlines the specific processes that USACE will follow to identify and treat cultural resources. The PA took effect after it was signed by USACE and the SHPO on June 8, 2012, and was subsequently transmitted to the Advisory Council on Historic Preservation.

Following the terms of the PA, before construction begins, the following will occur:

- USACE and the SHPO would formally agree upon a final area APE for the project. The APE comprises the entirety of the area where cultural resources could potentially be affected by the project.
- USACE, in consultation with the SHPO, would fully inventory the APE for cultural resources. This inventory would include both the pedestrian survey efforts conducted to date by ICF, as well as subsurface prospection efforts.
- In consultation with the SHPO, USACE would evaluate all cultural resources in the APE for their eligibility for listing in the National Register of Historic Places (NRHP). Work necessary for these evaluations may include detailed recordation, background research, and subsurface test excavations.

- USACE; in consultation with the SHPO, the public, interested Native American Tribes, or other identified stakeholders; would provide adequate mitigation to resolve any unavoidable adverse effects to NRHP eligible cultural resources (historic properties).

Alternative SB-8 could result in impacts to the levee itself, the Sutter Butte Canal, historic buildings and neighborhoods in Yuba City, other built environment resources identified in the FRWLP EIS/EIR, and several known prehistoric archaeological sites (CA-SUT-5, CA-SUT-10, CA-SUT-20, CA-SUT-77, CA-BUT-52, CA-BUT-53, CA-BUT-496, CA-BUT-1123, and the unnamed site identified by UAIC). USACE would follow the processes outlined in the PA to resolve adverse effects to these resources.

Proposed borrow areas have not yet been surveyed. Inventories of the borrow sites, utility relocations, and other sites that may be defined in the future, could result in the identification of more impacts.

Any unknown cultural resources found in the course of further inventory work or during construction would be evaluated for NR eligibility, and effects to those resources would be resolved as necessary, following the processes outlined in the PA.

5.5 Fill, Borrow, Borrow Sites and Disposal Areas

Type 1, Type 2 and Random fill materials are needed for levee, cutoff wall and seepage berm constructions. Type 1 levee fill material will be used primarily as a clay core for the reconstructed levee above the cutoff wall and for the cutoff wall's soil-bentonite mix. Type 2 levee fill material will be used primarily for shells for the reconstructed levee above the cutoff wall. Random fill is used primarily for seepage berms.

Excavated materials from levee degrade are expected to be reusable for Type 1 and Type 2 fills. Type 1 fill can be used as Type 2 and Random Fill. Type 2 fill can be used as Random fill. It is expected that borrow materials will be needed for construction of the project.

The two primary types of borrow material for the levee and cutoff wall constructions are: Type 1 and Type 2. Specifications for the two material types (see Paragraph 2.4.4.3) are as follows:

- Type 1 Levee Fill: USCS classification of CL, SC, or CH and maximum particle size of 2 inches; minimum 35% by weight passing the #200 sieve; maximum liquid limit of 60; plasticity index between 12 and 40.

- Type 2 Levee Fill: Maximum particle size of 2 inches; minimum 12% by weight passing the #200 sieve; maximum liquid limit of 45.

The borrow areas are sites 2 to 5, 7, 8, 11 and 12 shown in Plate 5-3. Source for borrow is discussed in Paragraph 2.6. A material balance analysis was completed for borrow quantities based on the preliminary information and the results are show in Tables 5-5 and 5-6.

Implementation of Alternative SB-7/SB-8 may generate up to 813,000 cubic yards of solid waste that would require disposal. Sources of solid waste related to construction activities would include levee material, structural debris from removal of residences and agricultural structures, roadway pavements, and levee material deemed unsuitable for reuse.

The nearest solid waste facilities to the project area are the Ostrom Landfill (located east of the project site, approximately 30 road miles from the southern end of the project at Reach 2) and the Neal Road Landfill (located 25 miles north of the project Reach 40).

Assuming all of the estimated 813,000 cubic yards of waste material would require permanent disposal, Alternative SB7/SB8 implementation would represent 2% of the Ostrom Road Landfill and 4% of the Neal Road Landfill remaining capacities. However, the option of beneficial reuse is likely to reduce the cubic yards of soil that require permanent disposal as discussed in paragraph 2.10.3.2 above.

5.6 Construction Access, Haul Routes and Staging Areas

Haul route will be mainly on existing public roads (see Plate 5-3).

5.7 Real Estate Requirements

A total of 34 physical structures fall within the proposed ROW and, therefore, will be demolished for construction of this alternative. 27 of these structures are within reach 16 (Yuba City). The remaining structures are in reaches 26 to 31.

Approximately 2,196 acres will be acquired and 468 parcels will be impacted (refer to Real Estate Appendix for more details).

5.8 Operation and Maintenance, Repair, Replacement and Rehabilitation (OMRR&R)

5.8.1 Flood Damage Reduction Features

OMRR&R Activities for flood control works are generally the same with and without the project. However the cost and effort associated with each activity may increase or decrease as a result of the project. These increases or decreases are considered to be roughly offsetting and net change in overall OMRR&R effort is judged to be insignificant. Expected impacts of the project on these activities are as follows:

1. Construction activities including reconstruction of the upper half of the levee, regrading of side slopes vegetation removal, rodent disruption and crown road reestablishment will reduce maintenance costs in the short term.

2. Vegetation removal/control. For the purpose of this feasibility study it is assumed that, absent the project, the State will gradually bring levees into compliance with USACE ETL 1110-2-571 using a life cycle approach to vegetation management. Under this assumption, the immediate compliance with the ETL required by the project will result in an interim increase in

cost and effort required for vegetation removal and control (Offset initially by clearing during construction). Net increase in OMRR&R cost anticipated.

3. Rodent control/damage repair. Increase in embankment volume resulting from the addition of seepage and stability berms could result in a slight increase in rodent related maintenance activity.

4. Slope maintenance. Reduction in OMRR&R will occur due to reduction in seepage. The VFZ required by USACE ETL 1110-2-571 for the project area will reduce the need for periodic levee toe regrading previously caused by farming operations.

5. Repair of waterside erosion. No additions. No significant change.

6. Encroachments. Wet penetration encroachments will be improved or eliminated throughout the length of the project. Dry encroachments, such as power poles and vegetation will be reduced. The result will be a decrease in OMRR&R costs.

7. Road/ramp maintenance. The addition of an O&M road at the toe of the levee for the entire length of the levee in addition to the existing road on the levee crown will essentially double the cost and effort associated with road maintenance. However, the added road will enhance the efficacy of virtually all OMRR&R activities including inspections, patrolling and flood fighting.

8. Encroachments. Wet penetration encroachments will be improved or eliminated all along the length of the project. Dry encroachments, such as power poles and vegetation will be reduced. Result will be decrease in OMRR&R costs.

9. Road/ramp maintenance. The addition of an O&M road at the toe of the levee for the entire length of the levee in addition to the existing road on the levee crown will essentially double the cost and effort associated with road maintenance. However, the added road will enhance the efficacy of virtually all OMRR&R activities including inspections, patrolling and flood fighting.

10. Inspection/patrolling including participation in Federal and State inspection programs, routine patrolling to identify maintenance needs and to assure flood worthiness, and continuous patrolling during high water conditions. The added landside O&M toe road will significantly enhance inspection and patrolling activities.

11. Flood fighting. The project flood control features (seepage berms, stability berms, and cutoff walls) are intended to eliminate seepage and stability issues during high water. The added O&M road at the landside levee toe should dramatically improve identification of any issues that may develop during high water and facilitate their rapid repair.

5.8.2 Mitigation Features

For Alternative SB-8 an estimated 90 acres are designated for mitigation of habitat loss due to project construction. An estimated 35 acres are available at the Star Bend mitigation site. Additional mitigation needs will be accomplished with additional mitigation sites and/or mitigation bank credits. USACE will enter into a contract to preserve the plantings for a term of three years following completion of construction. At the end of this term the areas will be turned over to the local sponsor who will maintain the areas to accomplish predetermined levels of re-vegetation success targeted for 5 years from planting.

5.8.3 Estimated Annual OMRR&R Cost

The estimated cost of OMRR&R for Alternative SB-8 in 2012 dollars is $ 454,000 as compared to $ 432,000 for the same levee reaches without the Project. See Table 2-3.

5.9 Cost Estimate and Construction Schedule

The total first cost for alternative SB-8 is $694,010. The estimated fully funded cost is $797,700. Details are shown in the Cost Engineering Appendix.

The project is divided into 7 construction contracts those are A, B, C1, C2, D1, D2 and Star Bend Fix-in-place (SBFIP). Table 5-4 summarizes the extent, year of construction and project features for each of the construction contracts. For more information on construction contracts and their sequencing, refer to the Cost Engineering Appendix.

TABLES

Table 2-1 1957 Design Flows compared to Regulated Peak Flows

Stream and Reach	1957 Authorized Design Flow (CFS)	Regulated Peak Flows (CFS)						
		50% ACE	10% ACE	4% ACE	2% ACE	1% ACE	0.5% ACE	0.2% ACE
Sacramento River								
Colusa to Tisdale Weir	66,000	44,000	48,000	50,000	53,000	55,000	59,000	68,000
Tisdale Weir to Sutter Bypass	30,000	28,000	30,000	31,000	32,000	34,000	36,000	41,000
Feather River								
Oroville to Honcut Creek	210,000	60,000	100,000	150,000	150,000	150,000	174,000	320,400
Honcut Creek to Yuba River	210,000	49,000	107,000	157,000	159,600	163,000	182,000	293,600
Yuba River to Bear River	300,000	71,000	192,000	256,000	281,000	283,000	360,000	534,000
Bear River to Sutter Bypass	320,000	78,000	211,000	288,000	321,000	336,000	409,000	574,000
Sutter Bypass								
Meridian to Wadsworth Canal	150,000	57,000	102,000	126,000	155,000	184,000	228,000	327,000
Wadsworth Canal to Tisdale Weir	155,000	58,000	103,000	127,000	156,000	185,000	229,000	327,000
Tisdale Weir to Feather River	180,000	71,000	117,000	141,000	163,000	197,000	237,000	329,000
Feather River to Sacramento River	380,000	141,000	283,000	393,000	436,000	490,000	581,000	799,000
Wadsworth Canal								
Tributary Specific Storm Centering	1,500	820	2,550	3,200	3,980	4,830	5,750	7,070
Cherokee Canal								
Nelson Shipee Road to Western Canal	8,500							
Western Canal to Afton Road	11,500	6,000	10,300	12,100	13,200	14,300	15,200	16,300
Afton Road to Gridley – Colusa Road	12,500							

Table 2-2 Percentages of Levee Degrade Suitable for Levee Fill

Reach ID	Percentage for Levee Core (Type 1)	Fraction	Percentage for Levee Shell (Type 2)	Fraction
2A-North	5	0.05	95	0.95
2B	5	0.05	95	0.95
3	5	0.05	95	0.95
4	5	0.05	95	0.95
5	5	0.05	95	0.95
6	5	0.05	95	0.95
7	40	0.4	60	0.6
8	0	0	85	0.85
9	0	0	55	0.55
10	0	0	70	0.7
11	0	0	100	1
12	NA	NA	NA	NA
13	0	0	95	0.95
14	NA	NA	NA	NA
15	NA	NA	NA	NA
16	NA	NA	NA	NA
17	0	0	100	1
18	15	0.15	85	0.85
19	30	0.3	70	0.7
20	0	0	100	1
21	0	0	100	1
22	15	0.15	85	0.85
23	0	0	90	0.9
24	0	0	100	1
25	0	0	100	1
26	0	0	100	1
27	80	0.8	20	0.2
28	15	0.15	85	0.85
29	NA	NA	NA	NA
30	0	0	95	0.95
31	30	0.3	70	0.7
32	0	0	100	1
33	0	0	100	1
34	0	0	100	1
35	0	0	100	1
36	0	0	100	1
37	0	0	100	1
38	0	0	100	1
39	NA	NA	NA	NA
40	60	0.6	0	0
41	60	0.6	0	0

Table 2-3 OMRR&R Cost Estimates

Alternative	W/O Project	With Project	Difference (Increase)
SB-7	$ 264,000	$ 277,000	$ 13,000
SB-8	$ 432,000	$ 454,000	$ 22,000

Table 4-1A Summary of Project Features for Alternative SB-7

	Feature Description	Quantity
Alternative SB7 Reach 2A-North to 21 180+00 to 1433+83 2017 - 2021	No Modification Required	16,230LF
	Cutoff Wall Only	84,700LF
	Jet Grouting Cutoff Wall Only	560LF
	Seepage Berm Only	350LF
	Cutoff Wall with Full Levee Degrade and Existing Relief Wells	5,300LF
	Cutoff Wall with Full Levee Degrade	N/A
	Cutoff Wall with Existing Relief Wells	5,930LF
	Cutoff Wall with New Relief Wells (22 Wells)	2,500LF
	Cutoff Wall with Seepage Berm	7,670LF
	Cutoff Wall with Levee Relocation	N/A
	Cutoff Wall with Sutter Butte Canal Relocation	370LF
	Cutoff Wall with Landside Toe Fill	1,870LF
	DSM Cutoff Wall (subpart of the Cutoff Wall Only area)	7,030LF
	Erosion Protection	5,760LF
	Utilities and Encroachments (Total)	269
	Utilities and Encroachments (To be modified)	123
	Land Acquisition	2,110AC
	Impacted parcels	292
	Potential structural demolitions	27
	Closure Structures (stop logs)	1

Table 4-1B Summary of Project Features for Alternative SB7

Engineering Appendix Paragraph	Measure	Typical Section (Plate)	Segment	Contract	Beg. STA of Measure	End. STA of Measure	Length per Segment (LF)	Length per Contract (LF)	Length per Measure (LF)
4.2.1	No Rehabilitation Required	-	1	B	831+50	844+50	1,300	1,300	
	No Rehabilitation Required	-	2	C1	923+75	1006+24	8,249		
	No Rehabilitation Required	-	3	C1	1007+70	1024+00	1,630		
	No Rehabilitation Required	-	4	C1	1027+50	1078+00	5,050	14,930	16,230
4.2.2	Cutoff Wall Only	G-2A	1	A	231+00	453+00	22,200	22,200	
	Cutoff Wall Only	G-2A	2	SBFIP	478+68	512+00	3,332	3,340	
	Cutoff Wall Only	G-2A	3	B	570+00	831+50	26,150	26,150	
	Cutoff Wall Only	G-2A	4	C1	1078+00	1096+00	1,800		
	Cutoff Wall Only	G-2A	5	C1	1098+10	1107+00	890		
	Cutoff Wall Only	G-2A	6	C1	1125+70	1129+99	429		
	Cutoff Wall Only	G-2A	7	C1	1130+20	1213+85	8,365	11,490	
	Cutoff Wall Only	G-2A	7	C2	1213+85	1429+00	21,515	21,520	84,700
4.2.3	Jet Grouting Cutoff Wall Only	G-2A	1	C1	1006+04	1007+90	186		
	Jet Grouting Cutoff Wall Only	G-2A	2	C1	1095+80	1098+30	250		
	Jet Grouting Cutoff Wall Only	G-2A	3	C1	1129+50	1130+67	117	560	560
4.2.4	Seepage Berm Only	G-2B	1	C1	1024+00	1027+50	350	350	350
4.2.5	Cutoff Wall with Full Levee Degrade and Existing Relief Wells	G-2D	1	C1	844+50	897+50	5,300	5,300	5,300
4.2.5	Cutoff Wall with Full Levee Degrade	G-2D	-	-	0+00	0+00	0	0	0
4.2.6	Cutoff Wall with Existing Relief Wells	G-2C	1	B	512+00	545+00	3,300	3,300	
	Cutoff Wall with Existing Relief Wells	G-2C	3	C1	897+50	923+75	2,625	2,630	5,930
4.2.6	Cutoff Wall with New Relief Wells	G-2C	2	B	545+00	570+00	2,500	2,500	2,500
4.2.7	Cutoff Wall with Seepage Berm	G-2C	1	A	180+00	231+00	5,100		
	Cutoff Wall with Seepage Berm	G-2C	2	A	453+00	478+68	2,568	7,670	7,670
4.2.8	Cutoff Wall with Levee Relocation	G-2E	-	-	0+00	0+00	0	0	0
4.2.9	Cutoff Wall with Sutter Butte Canal Relocation	G-2F	1	C2	1429+00	1432+70	370	370	370
4.2.10	Cutoff Wall with Landside Toe Fill	G-2G	1	C1	1107+00	1125+70	1,870	1,870	1,870
4.2.11	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	1	A	230+00	250+00	2,000	2,000	
	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	2	C1	1125+00	1129+99	499		
	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	3	C1	1130+20	1151+50	2,130	2,630	
	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	4	C2	1224+00	1248+00	2,400	2,400	7,030
4.2.12	Erosion Protection	-	1	B	547+00	604+60	5,760	5,760	5,760
4.2.13	Closure Structure (Stop Log)	-	1	C1	1130+00	1130+00	-	-	-

Table 4-2 Summary of Project Features for Alternative SB7

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
2A North	180+00 to 202+50	2,250	Cutoff wall with undrained seepage berm	180+00 to 202+50: 100 ft. wide undrained seepage berm. Seepage berm 5 ft. thick at berm toe. 180+00 to 202+50: Cutoff wall extending to an elevation of 25 ft.	
2B	202+50 to 218+66	1,616	Cutoff wall with undrained seepage berm	180+00 to 218+66: 100 ft. wide undrained seepage berm. Seepage berm 5 ft. thick at berm toe. 202+50 to 218+66: Cutoff wall extending to an elevation of 25 ft.	
3	218+66 to 300+66	8,200	Cutoff wall Cutoff wall with undrained seepage berm	218+66 to 231+00: 100 ft. wide undrained seepage berm. Seepage berm 5 ft. thick at berm toe. 218+66 to 230+00: Cutoff wall extending to an elevation of 25 ft. 230+00 to 250+00: Cutoff wall extending to an elevation of -35 ft. 250+00 to 289+00: Cutoff wall extending to an elevation of -20 ft. 289+00 to 300+66: Cutoff wall extending to an elevation of -12 ft.	
4	300+66 to 410+67	11,001	Cutoff wall	300+66 to 312+00: Cutoff wall extending to an elevation of -12 ft. 312+00 to 349+00: Cutoff wall extending to an elevation of 15 ft. 349+00 to 368+00: Cutoff wall extending to an elevation of 10 ft. 368+00 to 410+67: Cutoff wall extending to an elevation of 20 ft.	

Table 4-2 Summary of Project Features for Alternative SB7

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
5	410+67 to 478+68	6,801	Cutoff wall Cutoff wall with undrained seepage berm	453+00 to 478+00: 300 ft. wide undrained seepage berm. Seepage berm 5 ft. thick at berm toe. 410+67 to 417+00: Cutoff wall extending to an elevation of 20 ft. 417+00 to 425+00: Cutoff wall extending to an elevation of 10 ft. 425+00 to 456+00: Cutoff wall extending to an elevation of 15 ft. 456+00 to 475+35: Cutoff wall extending to an elevation of 15 ft. 475+35 to 478+68: Cutoff wall extending to an elevation of 15 ft.	
6 FIP	478+68 to 512+00	3,332	Cutoff wall	478+68 to 512+00: 65ft deep (from degrade line) cutoff wall.	
7	512+00 to 596+00	8,563	Cutoff wall Cutoff wall with existing and new relief wells Erosion Protection	512+00 to 514+00: 65ft deep (from degrade line) cutoff wall. 514+00 to 526+00: Cutoff wall tip elevation +15 feet 526+00 to 570+00: Cutoff wall tip elevation -5 feet 545+00 to 570+00: 22 new relief wells at 120 feet spacing and 50 feet depth (including new concrete lined V-ditch). 570+00 to 575+00: Cutoff wall tip elevation -5 feet 575+00 to 595+00: Cutoff wall tip elevation -10 feet 595+00 to 596+00: Cutoff wall tip elevation +15 feet 547+00 to 596+00: High Performance Turf Reinforce Mat (HPTRM)	512+00 to 545+00: existing seepage interceptor system (24 relief wells, ditch and pump station) are to remain.
8	596+00 to 654+75	5,875	Cutoff wall Erosion Protection	596+00 to 654+75: Cutoff wall tip elevation +15 feet 596+00 to 604+60: High Performance Turf Reinforce Mat (HPTRM)	

Table 4-2 Summary of Project Features for Alternative SB7

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
9	654+75 to 706+50	5,175	Cutoff wall	654+75 to 670+00: Cutoff wall tip elevation +15 feet 670+00 to 697+00: Cutoff wall tip elevation +20 feet 697+00 to 706+50: Cutoff wall tip elevation -10 feet	
10	706+50 to 774+00	6750	Cutoff wall	706+50 to 726+00: Cutoff wall tip elevation -10 feet 726+00 to 746+00: Cutoff wall tip elevation -5 feet 746+00 to 754+50: Cutoff wall tip elevation +5 feet 754+50 to 774+00: Cutoff wall tip elevation +25 feet	
11	774+00 to 830+00	5,600	Cutoff wall	774+00 to 784+50: Cutoff wall tip elevation +25 feet 784+50 to 827+50: Cutoff wall tip elevation -5 feet 827+50 to 830+00: Cutoff wall tip elevation +25 feet	
12	830+00 to 845+00	1,500	No proposed rehabilitation measure with exception below Cutoff wall (transition only, at both ends of this reach)	830+00 to 831+50: Cutoff wall tip elevation +25 feet (transition only) 844+50 to 845+00: Cutoff wall tip elevation -26 feet (transition only)	829+85 to 845+25: existing cutoff wall (23.5ft deep, tip elevation 30.5)
13	845+00 to 927+00	8,200	Cutoff wall Cutoff wall with full levee degrade and existing relief wells	844+50 to 897+50: Full levee degrade and re-construction 844+50 to 849+00: Cutoff wall tip elevation -20’ to -29’ 848+00 to 863+00: Cutoff wall tip elevation -29’ 863+00 to 877+00: Cutoff wall tip elevation -30’ 877+00 to 887+00: Cutoff wall tip elevation -31’ 887+00 to 893+00: Cutoff wall tip elevation -30’ 893+00 to 897+50: Cutoff wall tip elevation -29’ 897+50 to 923+75: Cutoff wall tip elevation +25’	844+50 to 897+50: Existing seepage interceptor system (52 relief wells, ditch and pump stations) are to remain. 897+50 to 923+75: Existing seepage interceptor system (29 relief wells, ditch and pump stations) are to remain. 923+23 to 927+00: existing cutoff wall (32.5ft deep, tip elevation 42.5)

Table 4-2 Summary of Project Features for Alternative SB7

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
14	927+00 to 954+40	2,740	No proposed rehabilitation measure	---	927+00 to 954+40: existing cutoff wall (32.5ft deep, tip elevation 42.5) No as-built drawing available for the existing cutoff wall.
15	954+40 to 968+50	1,410	No proposed rehabilitation measure	---	954+40 to 968+50: existing cutoff wall (32.5ft deep, tip elevation 42.5) No as-built drawing available for the existing cutoff wall.

Table 4-2 Summary of Project Features for Alternative SB7

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
16	968+50 to 1080+00	11,150	Jet grouting cutoff wall at 5th Street bridge crossing. Toe berm at 10th Street bridge crossing. Cutoff wall (transition only, at the end of Reach 16 to overlap existing cutoff wall).	1006+04 to 1007+90 (5th Street bridge crossing): Jet grouting cutoff wall tip elevation +40 feet 1023+90 to 1027+50 (10th Street bridge crossing): Toe berm, 23 feet wide, approximately 7 feet thick at the levee toe, 4H:1V slope at toe berm. 1077+85 to 1080+00: Cutoff wall tip elevation +30 feet and backfill landside toe depression (transition only).	968+50 to 983+23: existing cutoff wall (32.5ft deep, tip elevation 42.5) 983+23 to 996+23: existing cutoff wall (22.5ft deep, tip elevation 52.5) 996+23 to 1006+24: existing cutoff wall (32.5ft deep, tip elevation 42.5) 1007+90 to 1015+70: existing cutoff wall (32.5ft deep, tip elevation 42.5) 1015+70 to 1024+42: existing cutoff wall (43ft deep, tip elevation 35) 1026+99 to 1079+66: existing cutoff wall (39ft deep, tip elevation 38)

Table 4-2 Summary of Project Features for Alternative SB7

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
17	1080+00 to 1130+86	5,086	Cutoff wall Jet grouting cutoff wall at Yuba city water treatment plant Jet grouting cutoff wall at Railroad North of Yuba City Landside toe depression filled Closure Structure	1107+00 to 1125+70: Backfill landside toe depression 1080+00 to 1089+00: Cutoff wall tip elevation +30 feet 1089+00 to 1096+00: Cutoff wall tip elevation +35 feet 1095+80 to 1098+30: Jet grouting cutoff wall tip elevation +35 feet 1098+10 to 1125+00: Cutoff wall tip elevation +35 feet 1125+00 to 1129+99: Cutoff wall tip elevation +0 feet 1129+50 to 1130+67: Jet grouting cutoff wall tip elevation +0 feet 1130+20 to 1130+86: Cutoff wall tip elevation +0 feet 1130+00: Stoplog closure structure or equivalence	
18	1130+86 to 1213+85	8,299	Cutoff wall	1130+86 to 1151+50: Cutoff wall tip elevation +0 feet 1151+50 to 1159+50: Cutoff wall tip elevation +30 feet 1159+50 to 1169+50: Cutoff wall tip elevation +25 feet 1169+50 to 1189+50: Cutoff wall tip elevation +30 feet 1189+50 to 1209+50: Cutoff wall tip elevation +40 feet 1209+50 to 1213+85: Cutoff wall tip elevation +35 feet	
19	1213+85 to 1297+83	8,398	Cutoff wall	1213+85 to 1219+75: Cutoff wall tip elevation +35 feet 1219+75 to 1224+00: Cutoff wall tip elevation +5 feet 1224+00 to 1238+00: Cutoff wall tip elevation -28 feet 1238+00 to 1248+00: Cutoff wall tip elevation -42 feet 1248+00 to 1268+75: Cutoff wall tip elevation +3 feet 1268+75 to 1297+83: Cutoff wall tip elevation +35 feet	
20	1297+83 to 1374+33	7,650	Cutoff wall	1297+83 to 1298+75: Cutoff wall tip elevation +35 feet 1298+75 to 1359+00: Cutoff wall tip elevation +50 feet 1359+00 to 1369+00: Cutoff wall tip elevation +40 feet 1369+00 to 1374+33: Cutoff wall tip elevation +32 feet	

Table 4-2 Summary of Project Features for Alternative SB7

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
21	1374+33 to 1433+83	5,950	Cutoff wall Levee relocation with cutoff wall (transition only) Canal relocation	1374+33 to 1386+50: Cutoff wall tip elevation +32 feet 1386+50 to 1408+50: Cutoff wall tip elevation +55 feet 1408+50 to 1433+83: Cutoff wall tip elevation +40 feet 1429+00 to 1433+83 Sutter Butte Main Canal relocation.	

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
183	21	1430+55	2,216,425.27	6,664,383.06	Sunset Pump Station owned an operated by Sutter Extension Main Pump Station. There is a 60 Inch steel pipe through the levee. Pump end has gate valves on structure. Automatic drainage gates on the landside end.	Cutoff wall with Sutter Butte canal relocation	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(P)	15.6
184	21	1430+47	2,216,417.64	6,664,382.64	Sunset Pump Station owned an operated by Sutter Extension Main Pump Station. There is a 60 Inch steel pipe through the levee. Pump end has gate valves on structure. Automatic drainage gates on the landside end.	Cutoff wall with Sutter Butte canal relocation	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(P)	15.6
185	21	1430+40	2,216,410.86	6,664,382.27	Sunset Pump Station owned an operated by Sutter Extension Main Pump Station. There is a 36 Inch steel pipe through the levee. Pump end has gate valves on structure. Automatic drainage gates on the landside end.	Cutoff wall with Sutter Butte canal relocation	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(P)	15.6
186	21	1430+40			To construct and operate a vertical-perforated plate fish screen with a power operated brush on the right bank of Feather River. Located at Sunset Pump Plant.	Cutoff wall with Sutter Butte canal relocation		IR	
187	21	1430+00			36" CM pipe crossing through levee. The O&M manual indicates this pipeline is located 50 feet south of Sunset Pump Station but it appears this pipeline is the same pipeline addressed in Permit 4556 and 4719 located at Station 1465+50. The pipeline at Station 1465+50 was a 36 inch CMP installed in 1913 and removed in 1964. It should have shown on the O&M manual.	Cutoff wall with Sutter Butte canal relocation	There is no documenation of proper abandonment of the pipeline. We believe this pipeline was actually located at 1465+50 and removed per permit 4719. The type and size appear to match the Reclamation Board Permit. **Replace in accordance with USACE Standard.**	IR (G)	
188	21	1429+98	2,216,368.25	6,664,376.98	12 KV OH Power	Cutoff wall with Sutter Butte canal relocation		EL	OH
189	21	1429+68	2,216,338.71	6,664,376.58	12 KV OH Power	Cutoff wall with Sutter Butte canal relocation		EL	OH
190	21	1429+50			Existing rubble coffer dam constructed with Reclamation Board Permit 3610. Repair coffer dam.	Cutoff wall with Sutter Butte canal relocation		IR	
191	21	1428+50			Sutter Butte Main Canal Begin (Station 1428+50 to 1433+83) -Main Irrigation Canal approx 420 cfs	Cutoff Wall	**Recommended Relocation between station 1429+00 to 1433+83**	IR	
192	21				To construct a 12 KV pole line extension adjacent to the levee and across the floodway of the Feather River. The pole line will be located 30 feet from the waterside toe of the levee and will parallel the levee for a distance of 792 feet, thence across the floodway for a distance of 834 feet. The pole line extension will consists of three 264 foot spans and three 278 foot spans.	Cutoff Wall		EL	OH
193	21	1399+27	2,213,450.77	6,664,966.80	To install a 12 kv pole line across and along the right bank levee of the Feather River.	Cutoff Wall		EL	OH
194	21				To construct approximately 5,000 feet of lateral drain seepage relief trenches with perforated pipe and drain rock at the landward toe of the right bank levee for the Feather River. The proposed trench will be located at the landward levee toe at approximately 2 feet in width and 4 feet deep. LM 3.00 to 3.83 and LM 4.36 to 4.91. End Seepage Interceptor Trench	Cutoff Wall	No work proposed and the seepage drain can remain.	struc	
195	21				Plant 9 acres of Kiwi plants on waterside of levee between Bridgeford and Hermanson Avenues	Cutoff Wall		Trees	
196	21				Plant 14 acres of Kiwi plants on waterside of levee upstream of Hermanson Avenue	Cutoff Wall		Trees	
197	21				To construct a well and septic tanks for 2 mobile homes and to extend electrical service to well on right bank overflow area of Feather River	Cutoff Wall		Struc	

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
198	21				To plant 8 acres of kiwi plants, a submersible pump, and underground sprinkler system on the right bank overflow area of the Feather River	Cutoff Wall		Trees	
199	~~21~~				~~To pump storm water from landward drainage ditch over the right bank levee of the Feather River from one separate location for approximately size at the end of Hermansen Road.~~ ~~**Pipe has been removed**~~	~~Cutoff Wall~~		~~SD(P)~~	
200	21	1391+96	2,212,767.43	6,665,226.86	To extend a 12 kv pole line out into the right bank levee and overflow area of the Feather River	Cutoff Wall		EL	OH
201	21	1375+35	2,211,296.56	6,665,998.34	Sutter Extension Sunset Lateral Begin (Station 1375+35 to 1428+50) Open irrigation ditch 15 feet from landside toe	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	Struc	
202	21	1374+94	2,211,260.36	6,666,016.66	To construct approximately 5,000 feet of lateral drain seepage relief trenches with perforated pipe and drain rock at the landward toe of the right bank levee for the Feather River. The proposed trench will be located at the landward levee toe at approximately 2 feet in width and 4 feet deep. LM 3.00 to 3.83 and LM 4.36 to 4.91. Begin Seepage Interceptor Trench	Cutoff Wall		Struc	
203	21	1375+00			To level and plant 13 acres Peach Orchard on the right bank overflow area of the Feather River	Cutoff Wall		Trees	
	20/21	1374+33			Reach 20/21 Transition				
204	20	1350+00			To plant peach trees and to establish two wells and install pumping plants in right bank overflow of the Feather River	Cutoff Wall		struc	
205	20	1350+00			To extend 12 kv pole line parallel to the water ward toe of levee for a distance of approximately 1,500 feet north from Koch Lane, on the right bank overflow area of the Feather River/	Cutoff Wall		EL	OH
206	20				Excavation into toe of levee from 1 to 3 feet high and ground is tilled adajcent to the landside toe. The CVFPB sent an encroachment violation notice on August 17, 2011 to Julie M. Filter-Correll.	Cutoff Wall		Struc	
207	20	1347+37	2,208,612.74	6,666,676.45	To install a 60 foot pole 86 feet from the landward toe of the levee, a 60 foot pole 10 feet from the water ward toe of the levee and 6 additional poles on the right bank overflow of the Feather River. The 12kv electrical service will be extend across the levee to serve a pump installed under Permit 6380. The span across the levee will be 234 feet. The clearance between the overhead wires and the top of the levee will be 31 feet.	Cutoff Wall		EL	OH
208	20	1347+00	2,208,582.82	6,666,680.19	Missile Communication Cable System. Installation of an underground cable at a minimum depth of 3 feet, a corrugated metal cutoff wall is located on each cable, from Beale Air Force Base to the vicinity of Chico Airport, crossing several channels in Butte, Placer, Sutter, and Yuba Counties. In 1968 the USACE requested approval to abandon the cable in-place and cut	Cutoff Wall	The cable does not meet title 23 requirements. According to email from US Government to WR, the cable is no longer in use and can be disposed. **Replace in accordance with USACE standard**	TL	4.0
209	20	1345+00			To plant prune orchard on the right bank overflow area of the Feather River, downstream from Koch Road	Cutoff Wall		Trees	
210	20	1345+00			To retain walnut orchard on the right bank overflow area of the Feather River, downstream from Koch Road	Cutoff Wall		Trees	
211	~~20~~	~~1328+10~~			~~To install 3 temporary discharge pipelines across the right bank levee of the Feather River. The proposed pipeline will be in installed in three separate locations at LM 3.53, 3.72, and 3.78. The pipelines will be exposed on the levee slopes and will have a pad constructed over them across the levee crown.~~ ~~**Pipe has been removed.**~~	Cutoff Wall		~~SD(P)~~	

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
212	20	1328+00			To construct a 12 kv aerial power line on the right bank overflow area of the Feather River	Cutoff Wall		EL	OH
213	20	1327+00	2,206,597.56	6,666,928.33	12KV overhead power line crossing	Cutoff Wall		EL	OH
~~214~~	~~20~~	~~1317+15~~			~~To install 3 temporary discharge pipelines across the right bank levee of the Feather River. The proposed pipeline will be in installed in three separate locations at LM 3.53, 3.72, and 3.78. The pipelines will be exposed on the levee slopes and will have a pad constructed over them across the levee crown.~~ **~~Pipe has been removed.~~**	~~Cutoff Wall~~		~~SD(P)~~	
215	20	1315+03	2,205,398.45	6,666,943.63	To construct approximately 5,000 feet of lateral drain seepage relief trenches with perforated pipe and drain rock at the landward toe of the right bank levee for the Feather River. The proposed trench will be located at the landward levee toe at approximately 2 feet in width and 4 feet deep. LM 3.00 to 3.83 and LM 4.36 to 4.91. End Seepage Interceptor Trench	Cutoff Wall		Struc	
216	20	1314+80	2,205,375.80	6,666,944.25	Micheli Storm Drainage Pump Station. To install a pump with 20 Inch steel discharge pipe through the right bank of the Feather River for the removal of stormwater.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(P)	2.0
217	20	1312+08			To plant an orchard and grade the land on the right bank overflow area of the Feather River. The project is located north of Yuba City approximately 5.5miles.	Cutoff Wall		Trees	
~~218~~	~~20~~	~~1305+30~~			~~To pump storm water from landward drainage ditch over the right bank levee of the Feather River from one separate location for approximately size at the end of Hermansen Road.~~ **~~Pipe has been removed~~**	~~Cutoff Wall~~		~~SD(P)~~	
	19/20	1297+83			Reach 19/20 Transition				
219	19	1295+00			To plant an orchard and grade the land on the right bank overflow area of the Feather River. The project is located north of Yuba City approximately 1.3 miles upstream (north) of the intersection of Eager Road and Live Oak Boulevard.	Cutoff Wall		Trees	
220	19	1293+66	2,203,266.22	6,666,867.99	End Concrete Lined Ditch on landside toe of levee	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	struc	
221	19	1293+66	2,203,266.22	6,666,867.99	12 KV Overhead Power line crossing of levee. One pole 6 foot from levee toe.	Cutoff Wall		EL	OH
222	19				To construct approximately 5,000 feet of lateral drain seepage relief trenches with perforated pipe and drain rock at the landward toe of the right bank levee for the Feather River. The proposed trench will be located at the landward levee toe at approximately 2 feet in width and 4 feet deep. LM 3.00 to 3.83 and LM 4.36 to 4.91. Begin Seepage Interceptor Trench	Cutoff Wall		struc	
223	19	1284+91	2,202,406.27	6,666,705.08	Begin Concrete Lined Ditch on landside toe of levee	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	struc	
224	19	1266+71	2,200,600.09	6,666,626.50	12KV overhead power line crossing	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
225	19	1265+59	2,200,487.69	6,666,648.86	Sullivan Pump Station. 18 inch steel pipe through the levee. Pump and Gate valve in pump house on the channel bank. Concrete well on the bank. Siphon breaker in CMP riser on landside slope. (Sullivan Pump Station)	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and anti-siphon device on waterside hinge of levee. The pipe line is pressurized and need to be installed above the design water surface. The current installation is at-grade. **Replace in accordance with Title 23**	IR(P)	18.3

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
226	19	1229+41	2,197,325.05	6,668,184.53	Kewal Singh IR PS. A 16 inch steel pipe through levee. Pump in pump house on channel bank. Gate valve on the waterside end. Concrete standpipe.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and anti-siphon device on waterside hinge of levee. The pipeline is pressurized and will need to be installed about the design water surface. **Replace in accordance with USACE standard**	IR(P)	3.0 or deeper through levee?
227	19	1226+06	2,197,092.42	6,668,425.95	12 KV power pole located in landside slope	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
	18/19	1213+85			Reach 18/19 Transition				
228	18				Excavation into the toe of levee on waterside 0.5 to 3 feet high with near vertical slope. CFPB sent an encroachment violation notice on July 27, 2011 to Kewall Singh.	Cutoff Wall		struc	
229	18	1201+00			Wilbur Ranch Irrigation Water Well located within 50 feet of levee toe. Underconstruction as of March 6, 2012.	Cutoff Wall		well	
230	18	1200+69	2,194,694.58	6,669,169.33	Wilbur Ranch Irrigation Water Well located within 10 feet of levee toe. There is also a service pole and electrical panel.	Cutoff Wall	The water well does not meet Title 23 since too cloase to levee. The water well is located within the proposed right-of-way for levee project. **Relocate outside of of the proposed right-of-way.**	well	
~~231~~	~~18~~	~~1200+69~~	~~2,194,694.58~~	~~6,669,169.33~~	~~Abandoned 10 inch steel pipe through levee. Waterside end open. Steel Plate welded on landward end. Pump and Standpipe at the landside end.~~	~~Cutoff Wall~~	~~Not sure if the abandonment meets title 23 requirements. Pipe may need to be properly abandoned or completely removed.~~	~~IR(P)~~	~~2.8~~
232	18	1195+20			12 KV power line in overflow and levee crossing north of Rednall Road	Cutoff Wall		EL	OH
~~233~~	~~18~~	~~1182+75~~			~~20 Inch steel pipeline through levee **(not installed)** - Plans prepared by MHM Job No. 78-158~~	~~Cutoff Wall~~	~~Pipe eas never installed. No work.~~	~~IR(A)~~	~~3.0~~
234	18	1181+50			Abandoned 8 inch steel pipe through levee. Pipe plugged on the waterside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(A)	4.0
235	18	1180+98	2,192,727.96	6,669,163.92	3 inch steel pipe through levee crown	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(P)	1.0
236	18	1180+50			One 12 inch steel pipe through levee. Pipe exposed on landside slope	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(P)	1.0
237	18	1180+00			To construct a 15 inch diameter corrugated metal drain pipeline across the overflow area and through the right bank of the Feather River. The proposed pipeline will be 625 feet in length and have 15 feet of cover.	Cutoff Wall		SD(G)	
~~238~~	~~18~~	~~1182+75~~			~~To install an irrigation pump and a buried pipeline landward over the right bank levee of the Feather River, upstream Rednall Road. **Not install per Reclamation Board**~~	~~Cutoff Wall~~		~~IR(P)~~	
239	18	1174+05	2,192,034.01	6,669,096.85	Water Well and Pump 20 feet from Landside toe	Cutoff Wall	The water well is located within the proposed right-of-way for levee project. **Relocate outside of of the proposed right-of-way.**	well	
240	18	1170+04	2,191,638.99	6,669,057.61	12KV overhead power line crossing	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
241	18	1152+55	2,189,899.09	6,668,879.71	Twin 110 KV Tower line across Feather River	Cutoff Wall		EL	OH
242	18	1138+22	2,188,574.27	6,668,732.99	12 KV and 40/60 KV power pole located in landside slope	Cutoff wall	**Relocate outside of of the proposed right-of-way.**	EL	OH

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
243	18	1135+31	2,188,188.41	6,668,676.43	16 inch gas line through the levee. Marker post on the waterside shoulder	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	GL	3.5
244	18	1133+00			To construct 1,180 feet of 12 kv line in the right bank overflow area of the Feather River	Cutoff wall		EL	OH
	18	1132+61			Levee District No. 1 Levees /Levee District No. 9 Transition				
245	18	1132+09	2,187,967.19	6,668,647.98	8-5/8" steel pipeline within railroad right-of-way parallel to tracks	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	GL	
246	18	1131+82	2,187,840.25	6,668,647.20	Fiber optic cable	Cutoff wall	The cable does not meet title 23 requirements. **Replace in accordance with USACE standard**	TL	
	17/18	1130+86			Reach 17/18 Transition				
247	17	1130+47	2,187,705.38	6,668,643.93	Union Pacific Railroad Crossing. There is no stop log structure.	Jet Grouting		RR	6.0
248	17	1128+00			To construct a ramp on the waterside slope of the right bank levee on the Feather River adjacent to the SPRR.	Cutoff wall		Struc	
249	17	1127+48	2,187,405.84	6,668,629.29	Village Green Trailer Park - To install a 10 inch outfall pipe through the right bank levee of the Feather River to provide storm drainage for a mobile home park.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	
250	17	1125+00			An existing irrigation well in the right bank overflow area of the Feather River.	Cutoff wall with landside toe fill		Well	
251	17	1111+46	2,185,808.02	6,668,723.59	West Onstott Frontage Road Pump Station and Clark Avenue Pump Station Drainage Area. 16 Inch welded steel 7 GA asphalt coated storm drain discharge pipe over levee connected to 24 inch pipe in overflow area, outfall ditch, and pipes in floodway (Source: City of Yuba City Pump Station No. 4 and City of Yuba City Pump Station No. 2)	Cutoff wall with landside toe fill	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	1.1
252	17	1107+82	2,185,444.63	6,668,754.75	12 KV crossing & power pole located in landside slope	Cutoff wall with landside toe fill	**Relocate outside of of the proposed right-of-way.**	EL	OH
253	17				To install an intertie to an existing waste water line and abandon approximately 40 feet of 24 inch diameter pipe on the right bank of the Feather River.	Cutoff wall		RW(P)	4.0
254	17	1096+81	2,184,421.28	6,669,119.50	Yuba City Water Treatment Plant 28" (29 25/32" OD) 7 GA welded steel waterline pipe crossing of levee. New permit included installation of automatic drainage gates on pipelines. (copy of record drawings)	Jet Grouting	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	RW(P)	5.0
255	17	1096+71	2,184,412.72	6,669,124.71	Yuba City Water Treatment Plant 24" 7 GA welded steel waterline pipe crossing of levee. New permit included installation of automatic drainage gates on pipelines. (copy of record drawings)	Jet Grouting	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	RW(P)	4.7
256	17	1096+62	2,184,404.80	6,669,129.53	Yuba City Water Treatment Plant 42"cement mortar lined and coated welded steel pipe waterline crossing of levee (copy of record drawings)	Jet Grouting	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	RW(P)	2.5
257	17	1096+50	to be installed	to be installed	Yuba City Water Treatment Plant 48"cement mortar lined and coated welded steel pipe waterline crossing of levee (to be installed and requested by the City of Yuba City)	Jet Grouting	This is a new pipelines that will meet Title 23 and USACE requirements except as noted in variance column. **Replace in accordance with USACE standard**	RW(P)	2.0

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
258	17	1096+74	2,184,416.62	6,669,124.90	To install a 12 kv aerial pole line extension across the right bank levee of the Feather River. The pole line shall serve the Yuba City Water treatment Plant intake pump station	Jet Grouting		EL	OH
259	17	1093+12			Telephone Call box on landside hinge point	Cutoff wall	**Relocate outside of of the proposed right-of-way.**	TL	
260	17	1086+33			Construction of an 80 foot high Monopole for a Cell Tower. The work includes a 32' x 83' compound, PG&E 100 KVA transformer box, 600 AMP PG&E Electrical Meter Service.	Cutoff wall		Cell	
	16/17	1080+00			Reach 16/17 Transition				
261	16	1079+91	2,183,133.99	6,670,212.82	8 inch Gas Line	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	GL	3.5
262	16	1073+41	2,182,671.85	6,670,670.15	16 inch Gas Line (PG&E Map shows the gas main as 12 inch)	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	GL	3.5
263	16				Excavation into the levee on the waterside approximately 0.5 to 2 feet, near vertical in some places. Minor rutting, ponding, and depressions in the levee toe road. CVFPB sent a encroachment violation notice on August 16, 2011 to City of Yuba City.	No Rehabilitation Required		struc	
264	16	1054+75	2,181,074.23	6,671,588.96	Telephone Call box on landside hinge point	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	TL	
265	16	1043+52	not verified		Abandon 36 inch pipe	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SS(G)	
266	16	1043+52	2,180,149.57	6,672,223.24	Abandoned 27 inch Centrifugal Spun Concrete Pipe. City of Yuba City Drawing 214-D per 1949 plans	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SS(G)	38.6
267	16	1043+45	2,180,137.11	6,672,230.51	To install a 36 Inch discharge pipe through right bank of Feather River.	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	5.0
268	16	1043+27	2,180,126.23	6,672,235.13	To install a 24 inch wrapped steel pipe through the right bank levee of the Feather River	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	2.0

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
269	16	1043+22	2,180,121.72	6,672,237.88	To construct a 24 inch steel pipe storm drainage discharge pipe crossing the west levee of the Feather River	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	4.0
270	16	1043+03	2,180,106.36	6,672,244.70	Gilsizer Slough Storm Drain Facilities. A 16 inch welded steel discharge pipe crossing of levee. (copy of record drawings)	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	1.3
271	16	1037+50	Not Verified		Abandoned 8 inch gas line through levee. Removed per Permit 1445A	No Rehabilitation Required	Not sure if the abandonment meets title 23 requirements. Pipe may need to be properly abandoned or completely removed.	GL	
272	16				To construct approximately 4,400 lineal feet of filter trench adjacent to the right bank levee of the Feather River. The proposed trench will be located at the landward levee toe, be 3 feet wide and 4 feet deep.	No Rehabilitation Required			
273	16	1028+11	2,178,636.47	6,672,461.02	Power pole in waterside slope	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	EL	
274	16	1029+10	2,179,608.80	6,672,356.03	To bury existing two submarine telephone cables into two parallel trenches 100 feet apart in the channel of the Feather River. Both cables were installed per Permit 1334 in September 15, 1948. The permit stated the cable will be buried to a depth of five feet in the levees.	No Rehabilitation Required	The conduit may not meet title 23 requirements. **Replace in accordance with USACE standard**	TL	5.0
275	16	1028+10	2,179,506.59	6,672,370.16	To bury existing two submarine telephone cables into two parallel trenches 100 feet apart in the channel of the Feather River. Both cables were installed per Permit 1334 in September 15, 1948. The permit stated the cable will be buried to a depth of five feet in the levees.	No Rehabilitation Required	The conduit may not meet title 23 requirements. **Replace in accordance with USACE standard**	TL	2.0
276	16	1026+71	21,784,783.54	6,672,514.29	10" overside Drain line on the water side levee slope for bridge area drainage	Seepage berm	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	TL	
277	~~16~~	~~1026+70~~			~~To place a 10 Inch diameter conduit containing fiber optic cables across and under (bored) the channel and through the right bank of the Feather River. The permit was withdrawn on 9-6-00 according to the CVFPB file.~~	Seepage berm		TL	
278	16	1026+58	2,178,488.35	6,672,429.49	40 foot long retaining wall landside of levee just upstream of the Feather River Bridge	Seepage berm		Road	
279	16	1026+22	2,178,451.96	6,672,425.20	Feather River Bridge (SR 20) upstream side	Seepage berm		Bridge	
280	16	1025+32	2,178,375.92	6,672,443.76	Feather River Bridge (SR 20) downstream side	Seepage berm		Bridge	

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
281	16	1025+32	2,178,375.92	6,672,443.76	Seismic Retro of Feather River Bridge and bike paths on both sides of bridge	Seepage berm		Bridge	
282	16	1024+95	2,178,319.03	6,672,456.34	12 kv power line across levee	Seepage berm	**Relocate outside of of the proposed right-of-way.**	EL	OH
283	16	1024+70			Backfill Community Swimming Pool located near the base of the Feather River Bridge (10th Street Bridge)	Seepage berm		struc	
284	16	1024+48	2,178,296.55	6,672,470.53	40 foot long retaining wall landside of levee just downstream of the Feather River Bridge	Seepage berm		Road	
285	16	1021+95	2,178,044.07	6,672,487.29	12 kv power line across levee	No Rehabilitation Required		EL	OH
286	16	1021+00			Telephone line on river slope of levee 260 feet downstream of Feather River Bridge (10th Street Bridge)	No Rehabilitation Required		TL	
287	16	1020+85			Abandon 4 inch pipe	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SD(G)	1.3
288	16	1020+30	2,177,879.35	6,672,496.38	Telephone Call box on waterside hinge point	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	TL	
289	16	1019+82	2,177,832.15	6,672,504.71	Power pole in waterside slope	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	EL	OH
290	16	1013+00			To place approximately 4,000 feet of blanket drain and filter trench on the right bank of levee of the Feather River upstream and downstream of the SR 20 Bridge	No Rehabilitation Required		Struc	
291	16	1010+75	2,176,773.87	6,672,930.97	Install Guy within in landside slope of levee, 12 kV overhead electric	No Rehabilitation Required		EL	
292	16	1008+38	2,176,779.63	6,672,929.15	12 kv power line across levee	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	EL	OH
293	16	1007+50			To construct approximately 1,300 feet of 12 foot wide bicycle trail on the crown of the right bank levee of the Feather River. The Project is located in Yuba City between the 5th Street Bridge and the easterly extension of Teagarden Avenue.	Jet Grouting		Struc	
294	16	1007+50			4' by 3' deep erosion pocket. 4 foot vertical bank under Twin Cities Memorial Bridge	Jet Grouting		struc	
295	16	1007+50			To construct a bicycle trail for approximately 3.5 miles on the right bank levee other the Feather River from Shanghai Bend Road to Northgate Boulevard	Jet Grouting		Road	
296	16	1007+50			Bike Path below Twin Cities Memorial Bridge	Jet Grouting		Road	
297	16	1007+51	2,176,709.34	6,672,981.09	Twin Cities Memorial Bridge upstream side	Jet Grouting		Bridge	
298	16	1007+46	2,176,706.50	6,672,984.37	Light pole in water side levee slope	Jet Grouting	**Relocate outside of of the proposed right-of-way.**	EL	OH
299	16	1007+06	2,176,671.72	6,673,005.93	Twin Cities Memorial Bridge downstream side	Jet Grouting		Bridge	

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
300	16	1006+93	2,176,642.84	6,672,995.25	Power line and Anchor in Levee (actual location)	Jet Grouting		EL	
301	16	1006+60	2,176,647.27	6,673,046.63	Sacramento Northern Railroad	Jet Grouting		RR	
302	16	1006+07	2,176,610.55	6,673,084.90	Power Pole and anchor in slope of levee. 100 feet south of the SNRR bridge w/ service power overhead	Jet Grouting		EL	OH
303	16	1006+00			City of Yuba City. To replace the existing retaining wall with an 8 foot high, 76 foot long concrete retaining wall on the landside of the right (east) bank levee of Feather River.	Jet Grouting		struc	
304	16	1005+80			Concrete steps and 4 inch diameter PVC pipe on the landward slope and a pump house within 10 feet of the landward toe.	No Rehabilitation Required		struc/IR (P)	
305	16	1003+72	2,176,461.52	6,673,266.98	Power Pole and anchor in slope of levee. 300 feet south of the SNRR bridge	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	EL	OH
306	16	1000+50			A 3-wire barded wire fence with a gate within 5 feet of the levee toe and two mature trees at the landward toe. The project is located on Keyser Street	No Rehabilitation Required		struc	
307	16	999+90			A 120 foot long building at the landward toe	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	struc	
308	16	995+50			Authorize a 3-wire barded wire fence and two mature trees at the landward toe. The project is located at 563??? Second Street	No Rehabilitation Required		struc	
~~309~~	~~16~~	~~995+50~~			~~To excavate 25 feet into landward side of the right bank of the Feather River and construct a concrete retaining wall to provide parking lot space. The project is located at 463 2nd Street behind the Sutter County Administration Building/~~	~~No Rehabilitation Required~~		~~struc~~	
~~310~~	~~16~~	~~993+56~~			~~To install approximately 1,010 feet of 8 foot high chain link fence on the waterside side of the right bank levee of the Feather River.~~	~~No Rehabilitation Required~~		~~struc~~	
311	16	993+25			A building near the landward toe of the levee.	No Rehabilitation Required		struc	
312	16	992+00			A shed, concrete wall, and chain-link fence with gate at landward toe. The permit also covers two steel posts on the shoulder and seventeen mature trees on the landward slope	No Rehabilitation Required		struc	
313	16	991+00			A shed at the landward toe	No Rehabilitation Required		struc	
314	16	992+00			A two-story garage and shop building at the landward toe and six mature trees on the landward slope	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	struc	
315	16	989+75			A building at the landward toe and 21 mature trees and sprinkler system on the landward slope.	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	struc	
316	16	988+05	2,175,065.02	6,673,942.87	3 inch steel pipe, does not appear to cross levee anymore	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(P)	
317	16	989+20			A garage and a shed at the landward toe	No Rehabilitation Required		struc	
318	16	988+50			Authorize a small building, a chain-link fence, four mature trees at the landward toe, and five clumps of oleanders on the landward slope.	No Rehabilitation Required		struc	

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
319	16	987+60			Authorize a small building and a chain link fence on an existing retaining wall at the landward toe, concrete stairs, a steel pipe frame, and two large mature trees on the landward slope. A hose bib on the landward shoulder of the right bank of levee.	No Rehabilitation Required	**Recommended Relocation**	struc	
320	16	986+75			A see-through fence on a 5 foot retaining wall, steps, and nine mature trees on the landward slope.	No Rehabilitation Required		struc	
321	16	986+00			Concrete steps with railing and pomegranate bush on landward slope. The permit also covers a concrete retaining wall at the landward toe.	No Rehabilitation Required		struc	
322	16	985+30			Chain Link fence with gate, three oleander trees, and steps within the landward slope.	No Rehabilitation Required		struc	
323	16	984+50			Chain Link fence with gate, three oleander trees, and steps within the landward slope.	No Rehabilitation Required		struc	
324	16	983+20			A building, barbed wire fence, and ten trees at landward toe	No Rehabilitation Required		struc	
325	16	981+25			A 60 foot long see-through board fence and 75 foot long clothesline and landward toe. A shed 5 feet from landward toe and a mature oak tree on the landward slope	No Rehabilitation Required		struc	
326	16	980+15			A chain-link fence with gate within 10 feet of landward toe	No Rehabilitation Required		struc	
327	16	979+90			A see-through fence and storage shed within 10 feet of the landward toe. The project is located at 265 Second Street, Yuba City, CA	No Rehabilitation Required		struc	
328	16	979+40			A see-through fence and storage shed within 5 feet of the landward toe. The project is located at 261 Second Street, Yuba City, CA	No Rehabilitation Required		struc	
329	16	978+80			A Chain Link fence with gate within 5 feet of landward toe, a cedar tree at the landward toe, and stone steps on the landward slope. This project is located at 255 Second Street.	No Rehabilitation Required		struc	
330	16	976+10			A shed and three trees at the landward toe of the right bank levee of the Feather River. The project is located at 225 Second Street, Yuba City, CA 95591	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	struc	
331	16	975+40			A 6 foot high chain link fence and gate at the right bank levee of the Feather River	No Rehabilitation Required		struc	
332	16	974+25			A residence within 5 feet of the landward toe	No Rehabilitation Required		struc	
333	16	973+30			A residence at landward toe and oak on the landward slope	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	struc	
334	16	975+00			To construct a restroom facility with septic tank and leach lines at the Yuba City Boat Ramp on the right bank of the Feather River.	No Rehabilitation Required		struc	
335	16	972+29			2 Inch Domestic Water Line serving the Yuba City Boat Dock.	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with Title 23**	W(P)	
336	16	972+00			To construct improvement for the boat launching ramp and related facilities on the right bank of the Feather River.	No Rehabilitation Required		struc	
337	16	972+00			To construct improvement for the Yuba City Boat Ramp consisting of a paved parking area, restroom facilities, floating boat dock and extension of concrete boat ramp on the right bank of the Feather River.	No Rehabilitation Required		struc	

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
338	16	972+00			To reconstruct an existing access road to the Yuba-Sutter Boat Ramp on the right bank of the Feather River	No Rehabilitation Required		struc	
339	16	972+00			To maintain and operate existing boat dock for public use for boating, fishing, and a campground with related facilities including a mobile home on the right bank of the Feather River.	No Rehabilitation Required		struc	
	15/16	968+50			Reach 15/16 Transition	No Rehabilitation Required			
340	15	968+00			To construct 120 lineal feet of sheet piles retaining wall, and nine 10 x 10 foot boat docks supported by seven 12 inc diameter steel piles to an existing 30 foot wide ramp (Yuba City Boat Ramp)	No Rehabilitation Required	Located within floodway. Does not affect levee project.	struc	
341	15	964+78			Telephone Call box on waterside hinge point	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	TL	
	14/15	954+40			Reach 14/15 Transition	No Rehabilitation Required			
342	14	952+00			12 kv cable	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	EL	UG
	13/14	927+00			Reach 13/14 Transition	No Rehabilitation Required			
343	13	925+16			Telephone Call box on waterside hinge point	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	TL	
344	13	925+00			To construct access ramps	No Rehabilitation Required	Located within floodway. Does not affect levee project.	struc	
345	~~13~~	~~920+00~~			~~Consolidated Area Housing Authority of Sutter County. Strom Drainage Pipe Crossings. The size and location of the pipe is unknown. They have retention pond located at southwest corner of the airport. The Airport Business Park proposed crossing but application never filed.~~	~~Cutoff Wall~~	~~The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed.~~ ~~**Replace in accordance with Title 23**~~	~~SD (P)~~	
346	13	913+19	2,168,046.21	6,673,496.81	Two 16 inch gas lines. (PG&E map shows the gas lines as 2-12 inch)	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	GL	3.0
347	13	894+23	2,166,221.70	6,673,147.49	To install a 12kv buried power cable through the right bank levee and across the right bank overflow of the Feather River, a total distance of 896 feet. Poles will be installed near the top of the banks of the low water channel and aerial cable will be placed between the two poles which will be connected to the underground cable.	Cutoff Wall	The cable appears to meet title 23 requirements but the cutoff wall will remove improvements. **Replace in accordance with USACE standard**	EL	UG
348	13	893+84	2,166,181.41	6,673,142.43	Garden Highway Industrial Park. To install a 12 inch steel storm drain pipeline through the right bank levee of the Feather River (Source: City of Yuba City Pump Station No. 1)	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	3.3
349	13	893+78	2,166,175.45	6,673,142.43	Burns Drive Storm Water Pump Station. 16 inch steel storm drain discharge pipe through levee. (Source: City of Yuba City Pump Station No. 1)	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	2.7
350	13	881+40	2,164,942.19	6,673,036.13	Levee District No. 1 Relief Well Pump Station 6" pipes located just southeast of the Waste Water Treatment Plant. The waterside outlet structure has cobbles and the flap gate is damaged or plugged. CVFPB sent a notice of encroachment violation on August 16, 2011 to Sutter County.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Recommended Removal**	RW(P)	5.1

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
351	13	881+43	2,164,944.70	6,673,036.17	Levee District No. 1 Relief Well Pump Station 14" pipes located just southeast of the Waste Water Treatment Plant. The waterside outlet structure has cobbles and the flap gate is damaged or plugged. CVFPB sent a notice of encroachment violation on August 16, 2011 to Sutter County.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Recommended Removal**	RW(P)	5.1
352	13	856+23	2,162,702.52	6,674,085.34	South Yuba City Seepage Interceptor Pump Station 24 inch 7 GA Steel Pipe asphalt coated and wrapped with asphalt saturated felt discharge pipe (Source: City of Yuba City Pump Station No. ?)	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Recommended Removal**	SD(P)	5.2
353	13	856+08	2,162,689.81	6,674,093.30	South Yuba City Storm Drainage Pump Station 24 inch 7 GA Steel Pipe asphalt coated and wrapped with asphalt saturated felt discharge pipe (Source: City of Yuba City Pump Station No. 3)	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	5.2
354	13				Seepage Interceptor Trench and additional relief wells. The improvements were adjacent to the River Oaks subdivision between the wastewater treatment plant and Shanghai Road. All work on landside of levee.	Cutoff wall		struc	
355	13	849+85			Telephone Call box on waterside hinge point	Cutoff wall	**Relocate outside of of the proposed right-of-way.**	TL	
356	13				Bike Path below Twin Cities Memorial Bridge	Cutoff wall		struc	
	12/13	845+00			Reach 12/13 Transition				
~~357~~	~~12~~				~~Shanghai Bend Road Setback levee project~~	No Rehabilitation Required		~~struc~~	
358	12	832+24	to be installed	to be installed	City of Yuba City Sewer 24 inch welded steel pipe mortar lined and coated pipe discharge pipe. This pipeline shall replace the existing 24 inch located at Station 828+55. The existing pipeline will be removed and disposed.	No Rehabilitation Required	This is a new pipelines that will meet Title 23 and USACE requirements except as noted in variance column.	SS(P)	2.0
359	12	832+17	to be installed	to be installed	City of Yuba City Sewer 2-24 inch welded steel pipe mortar lined and coated pipe discharge pipe. This is a new pipeline requested by the City of Yuba City.	No Rehabilitation Required	This is a new pipelines that will meet Title 23 and USACE requirements except as noted in variance column.	SS(P)	2.0
	11/12	830+00			Reach 11/12 Transition				
360	11	828+55	2,160,267.77	6,675,134.01	City of Yuba City Sewer 24 inch welded steel pipe mortar lined and coated pipe (wall thickness 0.188" min) Discharge Pipe to river diffuser	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SS(P)	2.3
~~361~~	~~11~~				~~To place an 18 inch storm drain pipeline through the levee on the right bank of the Feather River **(project was not completed - no pipeline installed)**~~	~~Cutoff Wall~~		~~SD(P)~~	
	10/11	774+00			Reach 10/11 Transition	Cutoff Wall			
362	10	771+30			Construct a gaging station approximately 150 feet downstream form the present gaging station, known as Feather River below Shanghai Bend. It is proposed to install an 8 foot high by 5 foot 4 inch square recorder house on the right bank berm approximately 155 feet from centerline of levee.	Cutoff Wall		struc	
363	10	750+40	2,152,869.21	6,673,338.66	115 kv steel tower transmission line crossing of levee	Cutoff Wall		EL	OH
364	10	750+10	2,152,823.05	6,673,332.24	12 kv power line crossing of levee	Cutoff Wall		EL	OH
	9/10	706+50			Reach 9/10 Transition	Cutoff Wall			

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
365	9	692+00			To construct 140 lineal feet of sheet piles retaining wall, and nine 10 x 20 foot boat docks supported by seven 12 inch diameter steel piles to an existing 30 foot wide ramp (Boyd Pump Boat Ramp)	Cutoff Wall	Located within floodway. Does not affect levee project.	struc	
366	9	692+00			To improve the existing Boyd Pump Boat Launching Facility by widening the existing ramp to 30 feet with 4 foot walkways on each side, paving existing access road, and expanding parking area by 25 spaces, and placing riprap on the right bank of the Feather River.	Cutoff Wall		Struc	
367	9	692+00			To construct boat launching ramp, well, pump, pressure system, and sanitary facilities on the right bank overflow of the Feather River	Cutoff Wall		Struc	
368	9	689+09	2,146,949.33	6,672,031.04	Oswald Mutual Water Company (Boyd's Pump) 18 inch epoxy coated mortar lined steel pipe through existing 24 inch concrete pipe crossing of levee	Cutoff Wall	The pipeline does not meet title 23 requirements. The facility will need to go up and over the levee and will need a positive shut-off structure installed and anti-siphon device. **Replace in accordance with USACE standard**	IR(P)	27.6
369	9	689+00	2,146,953.52	6,672,029.11	To replace an existing pole line with a new pole line across the right bank levee of the Feather River. A new pole will be placed 10 feet landward of the landward toe of the levee and another pole will be placed 24 feet water ward of the water ward toe of the levee.	Cutoff Wall		EL	OH
370	9	689+00	2,146,953.52	6,672,029.11	To place a service line on a PG&E pole crossing the right bank levee of the Feather River	Cutoff Wall		TL	OH
371	9	688+90			Irrigation Production Well (located 25 foot west of landside levee toe)	Cutoff Wall		well	
372	9	669+20			Sierra Gold Nursery. Service Pole, Electrical Panel, Meter, and Irrigation Production Well 30 feet from landside levee toe.	Cutoff Wall		well	
373	9	664+07	2,144,450.88	6,672,127.42	Sierra Gold Nursery. An 8 inch steel pipe through levee. This pipe was pressure checked and in 1984 as part of permit 13980 to connect to existing pipe.	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off structure and anti-siphon device installed. **Replace in accordance with USACE standard**	SD(P)	3.6
374	9	664+20			To reconstruct and pave a 12 foot wide, approximately 1370 feet long road on the landside toe of the right bank levee of the Feather River	Cutoff Wall		struc	4.0
375	9	655+50			Service Pole, Electrical Panel, Water Well, Pump, and irrigation facilities	Cutoff Wall	The water well is located within the proposed right-of-way for levee project. **Relocate outside of of the proposed right-of-way.**	well	
	8/9	654+75			Reach 8/9 Transition				
376	8	649+11	2,142,954.74	6,672,128.18	Construct #3/4 ACSR 12kv pole line across the right bank levee of the Feather River, approximately 1900 feet southerly from Messick Road extended easterly to the river. Extension to serve 50 HP agricultural pump for C.E. Sullivan	Cutoff Wall		EL	OH
377	8	647+74	2,142,830.08	6,672,119.48	Feather Water District North Pump Station 1-26" irrigation discharge pipes	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off structure and anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	1.6
378	8	647+70	2,142,826.16	6,672,118.89	Feather Water District North Pump Station 1-26" irrigation discharge pipes	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off structure and anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	1.3

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
379	8	647+66	2,142,822.01	6,672,118.27	Feather Water District North Pump Station 1-26" irrigation discharge pipes	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off structure and anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	1.4
380	8	647+61	2,142,817.52	6,672,117.60	Feather Water District North Pump Station 1-26" irrigation discharge pipes	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off structure and anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	1.3
381	8	638+20			Service Pole, Electrical Panel, Water Well, Pump, Sand Seperator, Concrete Pad, and irrigation facilities (20 feet west of levee toe)	Cutoff Wall	The water well is located within the proposed right-of-way for levee project. **Relocate outside of of the proposed right-of-way.**	well	
382	8	622+79			Stand pipe, Service Pole, Electrical Panel, and Pump House, Water Well, and Pump at landside levee toe	Cutoff Wall	The water well does not meet Title 23 since too cloase to levee. The water well is located within the proposed right-of-way for levee project. **Relocate outside of of the proposed right-of-way.**	well	
383	8	622+79	2,140,350.59	6,671,955.66	Installation of a 12kv power line crossing of the right bank of the Feather River.	Cutoff wall		EL	OH
384	8	603+50			Service Pole, Electrical Panel, Water Well, Pump, Sand Seperator, Concrete Pad, and irrigation facilities (40 feet west of levee toe)	Cutoff wall	**Relocate outside of of the proposed right-of-way.**	well	
	7/8	596+00			Reach 7/8 Transition	Cutoff wall			
385	7	592+67	2,137,447.24	6,671,791.94	12 kv power line across levee	Cutoff wall		EL	OH
386	7	587+00	2,136,925.70	6,671,619.94	Spur Levee upstream of Abbott Lake	Cutoff wall		struc	
387	7				WS Slope varies from 3:1 near crown to 2:1 to 1:1 at toe. Sloughing and caving toe. Along slope I is hummocky; possibly from local slumping.	Cutoff wall		struc	
388	7				caving and slumping at toe. Rip rap berm toe. Diffcult to evaluate due to vegetation growth.	Cutoff wall		struc	
389	7	560+00			To fill in approximately one mile of an existing irrigation ditch at the waterside toe of the right bank of the Feather River.	Cutoff wall with existing relief wells	**Relocate outside of of the proposed right-of-way.**	Struc	
390	7				Bank caving 3 to 4 feet high, intermittent repair with rip rap berm at base of over steepened slope	Cutoff wall with existing relief wells		struc	
391	7	560+00			To construct a water well with a 14 inch casing in the right bank overflow of the Feather River at Abbott Lake	Cutoff wall with existing relief wells		well	
392	7	560+00			To extend approximately 2,500 of 12kv electric service line in the right bank overflow area of the Feather River near Abbott Lake to serve 25 HP Ag Pump for A.S. Cozzolino.	Cutoff wall with existing relief wells		EL	OH
393	7	557+00			Service Pole, Electrical Panel, Water Well, Pump, Sand Seperator, Concrete Pad, and irrigation facilities (50 feet west of levee toe)	Cutoff wall with existing relief wells	**Relocate outside of of the proposed right-of-way.**	well	
394	7	545+41	2,132,940.57	6,672,317.26	Crushed CMP Riser in Land Side Slope. Possible location of 8 inch steel pipe.	Cutoff wall with existing relief wells	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(A)	3.1
395	7	536+73	2,132,153.19	6,672,681.57	Existing 10 inch steel pipe. Removed in 1964 by Levee District No. 1 as part of permit 4775	Cutoff Wall		IR(?)	

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
396	7	536+64	2,132,149.73	6,672,692.81	5 inch steel drainage pipe	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SD(P)	2.0
397	7	532+00 to 596+00			Taylor Brothers. 15 Inch Irrigation Main located within 15 feet of landside toe	Cutoff Wall	The pipeline is within twenty (20) feet of the levee toe and does not meet Title 23. **Relocate outside of of the proposed right-of-way.**	IR (G)	
398	7	529+47	2,131,549.40	6,673,081.12	Abandon 6 inch pipe	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(A)	4.0
399	7	515+00			Seepage Interceptor Trench for Star Bend Relief Well Pumps	Cutoff Wall		struc	
400	7	512+08	2,130,379.55	6,674,329.99	Corp of Engineers Star Bend Road Relief Well Pump Station north 15" Steel Discharge Pipe Crossings	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure installed. **Replace in accordance with USACE standard**	SD(P)	3.8
401	7	512+04	2,130,375.66	6,674,332.71	Corp of Engineers Star Bend Road Relief Well Pump Station south 15" Steel Discharge Pipe Crossings	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure installed. **Replace in accordance with USACE standard**	SD(P)	3.7
402	7	510+97	2,130,288.81	6,674,393.77	12 kv power line crossing of levee	Cutoff Wall		EL	OH
	6/7	510+37			Reach 6/7 Transition	Cutoff Wall			
403	6	510+50			To retain a 12 kv overhead service line and four power poles in the right bank overflow area of the Feather River.	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
404	6	510+36	2,130,239.19	6,674,428.41	Volcano Vista Farms 18 inch steel irrigation discharge pipe crossing of levee	Cutoff Wall		IR(P)	4.0
405	6	510+30			To install 20 hp irrigation pump and to retain an existing walnut orchard (35 acres) all on the right bank of the Feather. Now owned by Volcano Vista Farms and located on Tudor Mutual Pump Station (relocated pipeline part of permit 18438)	Cutoff Wall		IR(P)	
406	6	510+25	2,130,230.41	6,674,434.54	Tudor Mutual Water Company North 30 inch steel irrigation discharge pipes crossing of levee	Cutoff Wall		IR(P)	4.2
407	6	510+20	2,130,222.24	6,674,437.45	Tudor Mutual Water Company South 30 inch steel irrigation discharge pipes crossing of levee	Cutoff Wall		IR(P)	4.1
408	6				12 inch steel pipe through levee	Cutoff Wall	The conduit may meet title 23 requirements but will need to be replaced during cutoff wall construction. **Replace in accordance with USACE standard**		
409	6				12 kv power line crossing of levee	Cutoff Wall			
410	6				12 kv power line crossing including 9 power poles and 3 anchors (appears to cover permit 2502 and 5072)	Cutoff Wall			
411	6				Abandon 14 inch pipe (this pipeline removed as part of 2009 setback levee project). Listed as 10" Steel in original 1955 O&M manual.	Cutoff Wall	**Recommended Removal**	IR(P)	4.1

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
412	6	509+00			To construct approximately 1,400 lineal feet of filter trench adjacent to the right bank levee of the Feather River	Cutoff Wall		Struc	
413	6	508+00			To clear, level, and plant a peach orchard on approximately 170 acres on the right bank of the Feather River.	Cutoff Wall		Trees	
414	6				Fix in-place the existing levee with 65ft deep cutoff wall between station 478+68 and station 512+00	Cutoff Wall		struc	
	5/6	478+68			Reach 5/6 Transition	Cutoff wall with seepage berm			
415	5	475+00			To plant walnut orchard in the right overflow area of the Feather River downstream from Star Bend	Cutoff wall with seepage berm		Trees	
	5	461+00			Urban (200 year) North - Nonurban (100 year) South Transition	Cutoff wall with seepage berm			
416	5	460+11	2,125,845.57	6,676,268.36	Abandon 8" steel drainpipe. The CVFPB sent an encroachment violation notice on August 16, 2011 to Dan Stephens Trust.	Cutoff wall with seepage berm	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SD(P)	4.1
417	5	442+80	2,124,212.69	6676803.8	Abandon 8" steel drainpipe	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SD(P)	4.1
418	5	433+50	2,123,304.56	6,677,004.67	Power line across levee to service pole with meter on waterside slope of levee	Cutoff wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
419	5	409+00 to 424+00			Taylor Brothers. 15 Inch Irrigation Main located within 15 feet of landside toe	Cutoff wall	The pipeline is within twenty (20) feet of the levee toe and does not meet Title 23. **Relocate outside of of the proposed right-of-way.**	IR (G)	
420	~~5~~	~~417+66~~	~~Not Verified~~		~~Abandon Existing 24 inch pipe through levee. The permit was revised to removal of 24 inch via 4666A so there should not be any pipe.~~	~~Cutoff wall~~		~~SD(G)~~	
	4/5	410+67			Reach 4/5 Transition	Cutoff wall			
421	4	410+53	2,121,173.09	66,776,661.21	Power line crossing to Feather Water District Pumps	Cutoff wall		EL	OH
422	4	409+84	2,121,105.29	6,677,660.77	To install a 2 inch electrical conduit through the levee. The conduit will be buried in the levee slopes and through the crown with one foot of cover. The conduit will provide electrical service to an existing pumping plant in the floodway of the Feather River.	Cutoff wall	The conduit may meet title 23 requirements but will need to be replaced during cutoff wall construction. **Replace in accordance with USACE standard**	EL	2.0
423	4	409+66	2,121,086.77	6,677,660.88	Feather Water District South Pump Station 1-18" irrigation discharge pipes. The improvements include a reservoir at the landside toe of levee and a inlet channel from river to waterside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure and new anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	0.8
424	4	409+62	2,121,082.47	6,677,660.77	Feather Water District South Pump Station 1-18" irrigation discharge pipes. The improvements include a reservoir at the landside toe of levee and a inlet channel from river to waterside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure and new anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	0.9
425	4	409+58	2,121,078.48	6,677,660.82	Feather Water District South Pump Station 1-18" irrigation discharge pipes. The improvements include a reservoir at the landside toe of levee and a inlet channel from river to waterside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure and new anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	0.8
426	4	409+55	2,121,075.08	6,677,660.80	Taylor Brothers Farm Irrigation Pump Station. A inclined pump located on the waterside slope of levee with 14 Inch Pipeline through levee	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure and new anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	1.4
427	4	409+50	2,121,069.88	6,677,660.77	Feather Water District South Pump Station 1-18" irrigation discharge pipes. The improvements include a reservoir at the landside toe of levee and a inlet channel from river to waterside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure and new anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	1.7

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
428	4	407+72	2,120,892.86	6,677,656.42	Abandoned pipe and structure at landside toe, pipe is 8 inch, but the headwall appears that it is ran through a larger older pipe possibly and old drainage pipe.	Cutoff Wall	The pipeline does not meet title 23 requirements and no longer in use. **Recommend Removal**	IR(A)	21.8
429	4	407+72	2,120,892.86	6,677,656.42	Taylor Brothers Production Water Well (facilities located at levee toe).	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	well	
430	4	396+32	2,119,752.28	6,677,651.86	8 inch pipe crossing. Headwall at land toe, art on land side of crown, and cut pipe near water side toe. CVFPB sent a notice of violation notice on October 4, 2011.	Cutoff Wall	The pipeline does not meet title 23 requirements and no longer in use. **Recommend Removal**	IR(P)	4.1
431	4	396+50 to 409+00			Taylor Brothers. 15 Inch Irrigation Main located within 15 feet of landside toe	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	IR (G)	
432	4	396+50 to 409+00			Feather Water District. 42 Inch Irrigation Main located within 10 feet of landside toe with standpipes	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	IR (G)	
433	4	396+20			Feather Water District Irrigation Production Well (facilities located 10 foot west of toe). CVFPB sent a notice of violation notice on October 4, 2011.	Cutoff Wall		well	
434	4	386+63	2,118,786.69	6,677,704.40	Abandon 8 inch pipe crossing, stand pipe on land toe has been destroyed. CVFPB sent a notice of violation on October 4, 2011.	Cutoff Wall	The pipeline does not meet title 23 requirements and no longer in use. **Recommend Removal**	IR(A)	4.6
435	4	365+00	2,116,703.78	6,678,265.36	Abandon 8 inch pipe crossing, stand pipe on land toe has been removed.	Cutoff Wall	The pipeline does not meet title 23 requirements and no longer in use. **Recommend Removal**	IR(A)	4.8
436	4	342+27	2,114,521.83	6,678,856.40	Irrigation Production Well (located xx foot west of levee toe)	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	well	
437	4	320+00			Approximately 500 horizontal feet of vertical excavation in the levee toe, cut 1 to 3 feet high. CVFPB sent out a encroachment violation notice on July 27, 2011 to Monasterio Family Trust.	Cutoff Wall		struc	
438	4	313+00			Approximately 100 horizontal feet of vertical excavation in the levee toe, cut about 3 feet high. Toe excavations are eroding and caving. CVFPB sent out a encroachment violation notice on September 12, 2011 to Monasterio Family Trust.	Cutoff Wall		struc	
	3/4	300+66			Reach 3/4 Transition				
439	3	298+89	2,110,314.83	6,679,535.86	Removal of a portion and filling with concrete a portion of an abandoned 36 inch steel pipe through the right bank levee of the Feather River	Cutoff wall	The pipeline does not meet title 23 requirements and no longer in use. **Recommend Removal**	IR(G)	
440	3	298+00			Approximately 600 horizontal feet of vertical excavation in the levee toe, cut 1 to 3 feet high. Toe excavations are eroding and caving. The CVFPB sent an encroachment violation notice on July 27, 2011 to Golden Gate Hop Ranch, Inc..	Cutoff wall		struc	
441	3	298+67	2,110,292.12	6,679,458.78	Garden Highway Mutual Water - Irrigation Production Well #23 (located 30 foot west of levee toe)	Cutoff wall		IR(W)	
442	3	298+38	2,110,262.81	6,679,553.51	Garden Highway Mutual Water 54 inch Irrigation Pump Station Discharge Pipeline through Levee. The improvements include a inlet channel from the river to the 200 feet from waterside toe of levee and irrigation canal at the toe of the landside of levee.	Cutoff wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure installed and new pipe. **Replace in accordance with USACE standard**	IR(G)	25.1
	3	280+90			State Maintenance Area 3 / Levee District No. 1 Levees Transition	Cutoff wall			
443	3	279+50			Garden Highway Mutual Water - Irrigation Production Well #4 (located 90 foot west of levee toe)	Cutoff wall		IR(W)	
444	3	274+50			Garden Highway Mutual Water - Irrigation Production Well #22 (located 20 foot west of levee toe)	Cutoff wall	The water well is located within the proposed right-of-way for levee project. **Relocate outside of of the proposed right-of-way.**	IR(W)	

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
445	3	241+75			Garden Highway Mutual Water - Irrigation Production Well #18 (located 50 foot west of levee toe)	Cutoff wall		IR(W)	
446	3	219+00			Garden Highway Mutual Water - Irrigation Production Well #19 (located 90 foot west of levee toe)	Cutoff wall with seepage berm		IR(W)	
447	3	219+00			12 inch pipe. Appears to be removed by pipe laying on ground adjacent to location	Cutoff wall with seepage berm	The pipeline does not meet title 23 requirements and no longer in use. **Recommend Removal**	IR(A)	
	2/3	218+66			Reach 2/3 Transition				
448	2	209+89	2,101,737.07	6,678,031.40	Electrical service crossing for pump	Cutoff wall with seepage berm	**Relocate outside of of the proposed right-of-way.**	EL	OH
449	2	209+23	2,101,673.35	6,678,014.21	Kuster Private Irrigation Pump Station. 14 inch welded steel pipe crossing	Cutoff wall with seepage berm	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure installed and new pipe. **Replace in accordance with USACE standard**	IR(P)	3.0
450	2	217+00			National Audubon Society. To plant approximately 4,000 native trees on 40 acres within the right bank overflow area of the Feather River.	Cutoff wall with seepage berm		Trees	
451	2	217+00			National Audubon Society. To plant approximately 300 to 500 native trees (primarily cottonwoods) on the right bank overflow area of the Feather River.	Cutoff wall with seepage berm		Trees	

Type 1A - Removal & Disposal of Abandoned Raised Pipe

Type 1B - Removal & Disposal of Abandoned Through Pipe

Type 2A - Removal & Replace of Raised Pipe

Type 2B - Removal & Replace of Through Pipe

Type 3A - Removal & Replace of Raised Pipe Adjacent to Canal

Type 3B - Removal & Replace of Through Pipe Adjacent to Canal

Type 3C - Removal & Replace of Through Pipe Under Canal

Vegetation ETL Compliance

Relocation of Utility/Structure Outside of The Proposed ROW

Additional Works

Not Applicable/No Rehabilitation Required

SD(G)	Storm Water - Gravity
SD(P)	Storm Water - Pressure
SS (G)	Waste Water - Gravity
SS (P)	Waste Water - Pressure
IR(G)	Irrigation Line - Gravity
IR(P)	Irrigation Line - Pressure
RW (P)	Raw Water - Pressure
W(P)	Water Line - Pressure
RD	
GL	Gas Line
TL	Telephone Line

TABLE 4-3 ALTERNATIVE SB7 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
		EL	Electrical Line						
		SEEP							
		STRUC	Structure						

Table 4-4A Summary of Construction Contracts for Alternative SB7

Features	Contract A Reach 2A-North to 5 180+00 to 478+68 2020 - 2021	Contract SBFIP Reach 6 478+68 to 512+00 2019 – 2020	Contract B Reach 7 to 12 512+00 to 845+00 2019 - 2020	Contract C1 Reach 13 to 18 845+00 to 1213+85 2017 – 2018	Contract C2 Reach 19 to 21 1213+85 to 1433+83 2017 – 2018
No Rehabilitation Required	N/A	N/A	1,300LF	14,930LF	N/A
Cutoff Wall Only	22,200LF	3,340LF	26,150LF	11,490LF	21,520LF
Jet Grouting Cutoff Wall Only	N/A	N/A	N/A	560LF	N/A
Seepage Berm Only	N/A	N/A	N/A	350LF	N/A
Cutoff Wall with Full Levee Degrade	N/A	N/A	N/A	N/A	N/A
Cutoff Wall with Full Levee Degrade and Existing Relief Wells	N/A	N/A	N/A	5,300LF	N/A
Cutoff Wall with Existing Relief Wells	N/A	N/A	3,300LF	2,630LF	N/A
Cutoff Wall with New Relief Wells (22 Wells)	N/A	N/A	2,500LF	N/A	N/A
Cutoff Wall with Seepage Berm	7,670LF	N/A	N/A	N/A	N/A
Cutoff Wall with Levee Relocation	N/A	N/A	N/A	N/A	N/A
Cutoff Wall with Sutter Butte Canal Relocation	N/A	N/A	N/A	N/A	370LF
Cutoff Wall with Landside Toe Fill	N/A	N/A	N/A	1,870LF	N/A
DSM Cutoff Wall (subpart of the Cutoff Wall Only area)	2,000LF	N/A	N/A	2,630LF	2,400LF
Erosion Protection	N/A	N/A	5,760LF	N/A	N/A
Utilities & Encroachments (Total, Table 4-4B)	37	12	46	129	45
Utilities & Encroachments (To be modified, Table 4-4B)	27	4	19	53	20
Land Acquisition					
Number of Impacted Parcel					
Number of Potential Structural Demolition					
Closure Structure	N/A	N/A	N/A	1	N/A

Table 4-4B Summary of Utilities & Encroachments for Construction Contracts

Color Codes	Types of Remediation	Alt. SB7	Construction Contracts				
			A	SBFIP	B	C1	C2
		Item No. 1 - 451	Item No. 415 - 451	Item No. 403 - 414	Item No. 357 - 402	Item No. 228 - 356	Item No. 142 - 227
	Type 1A - Removal & Disposal of Abandoned Raised Pipe	**16**	6	0	3	6	1
	Type 1B - Removal & Disposal of Abandoned Through Pipe	**3**	2	0	0	1	0
	Type 2A - Removal & Replace of Raised Pipe	**47**	7	0	9	25	6
	Type 2B - Removal & Replace of Through Pipe	**1**	1	0	0	0	0
	Type 3A - Removal & Replace of Raised Pipe Adjacent to Canal	**0**	0	0	0	0	0
	Type 3B - Removal & Replace of Through Pipe Adjacent to Canal	**0**	0	0	0	0	0
	Type 3C - Removal & Replace of Through Pipe Under Canal	**0**	0	0	0	0	0
	Vegetation ETL Compliance	**10**	3	1	0	0	6
	Relocation of Utility/Structure Outside of The Proposed ROW	**40**	8	1	7	18	6
	Additional Works	**6**	0	2	0	3	1
	Not Applicable/No Rehabilitation Required	**146**	10	8	27	76	25
Total Number of Utilities & Encroachments		**269**	37	12	46	129	45
Total Number of Utilities & Encroachments To Be Modified		**123**	27	4	19	53	20

Table 4-5 Borrow Sites and Usage for SB-7	**Volume of Material (Potential)**		
Borrow Sites and Usage	Type 1 (cy)	Type 2 (cy)	Random (cy)
2 - CDFG (OWA - Cobble Borrow)			330,800
3 - Live Oak Detention Basin	150,000		
4 - Lanza 235 Borrow	250,000		
5 - Nevis Property	250,000		
Left over after borrow for C2 - as type 1	197,900		
Left over after borrow for C2 - as type 2	184,400		
Left over after using borrow for C1 - as type 1	66,445		
Left over after using borrow for C1 - as type 2	53,102		
7 - Lanza 620 Acres Property	119,932	359,796	
Left over after using borrow for A - as type 1	948	19,986	
Left over after using borrow for A - as type 2			
8 - Huston Property	330,000		
Left over after using borrow for B - as type 1	199,279		
Left over after using borrow for B - as type 2	33,687		
11 - Siller Live Oak Property	250,000		
12 - Siller Yuba City Property		100,000	
Left over after borrow for SBFIP - as type 2		53,200	
Total Potential	1,349,932	459,796	330,800

Table 4-6 Borrow Demand for SB-7	**Volume of Material (Demand)**		
Borrow Sites and Usage	Type 1 (cy)	Type 2 (cy)	Random (cy)
CONTRACT A	118,984	339,810	
7 - Lanza 620 Acres Property	118,984	339,810	
CONTRACT STAR BEND (SBFIP)		46,800	
12 - Siller Yuba City Property		46,800	
CONTRACT B	130,721	165,592	
8 - Huston Property	130,721	165,592	
CONTRACT C1	117,955	13,343	
5 - Nevis Property	117,955	13,343	
CONTRACT C2	52,100	13,500	
5 - Nevis Property	52,100	13,500	
Total Demand	419,760	579,045	0

Table 5-1A Summary of Project Features for SB8

	Feature Description	Quantity
Alternative SB8 Reach 2A-North to 41 180+00 to 2688+00 2017 - 2023	No Modification Required	28,220LF
	Cutoff Wall Only	147,570LF
	Jet Grouting Cutoff Wall Only	960LF
	Seepage Berm Only	5,350LF
	Cutoff Wall with Full Levee Degrade and Existing Relief Wells	5,300LF
	Cutoff Wall with Full Levee Degrade	600LF
	Cutoff Wall with Existing Relief Wells	5,930LF
	Cutoff Wall with New Relief Wells (22 Wells)	2,500LF
	Cutoff Wall with Seepage Berm	7,670LF
	Cutoff Wall with Levee Relocation	11,610LF
	Cutoff Wall with Sutter Butte Canal Relocation	1,540LF
	Cutoff Wall with Landside Toe Fill	1,870LF
	DSM Cutoff Wall (subpart of the Cutoff Wall Only area)	19,790LF
	Erosion Protection	7,660LF
	Utilities and Encroachments (Total)	451
	Utilities and Encroachments (To be modified)	223
	Land Acquisition	2,196AC
	Impacted Parcel	468
	Potential Structural Demolition	34
	Closure structures (stop logs)	1

Table 5-1B Summary of Project Features for Alternative SB8

Engineering Appendix Paragraph	Measure	Typical Section (Plate)	Segment	Contract	Beg. STA of Measure	End. STA of Measure	Length per Segment (LF)	Length per Contract (LF)	Length per Measure (LF)
5.2.1	No Rehabilitation Required	-	1	B	831+50	844+50	1,300	1,300	
	No Rehabilitation Required	-	2	C1	923+75	1006+24	8,249		
	No Rehabilitation Required	-	3	C1	1007+70	1024+00	1,630		
	No Rehabilitation Required	-	4	C1	1027+50	1078+00	5,050	14,930	
	No Rehabilitation Required	-	5	C2	1625+00	1673+00	4,800	4,800	
	No Rehabilitation Required	-	6	D1	1769+40	1813+30	4,390	4,390	
	No Rehabilitation Required	-	7	D2	2303+00	2331+00	2,800	2,800	28,220
5.2.2	Cutoff Wall Only	G-2A	1	A	231+00	453+00	22,200	22,200	
	Cutoff Wall Only	G-2A	2	SBFIP	478+68	512+00	3,332	3,340	
	Cutoff Wall Only	G-2A	3	B	570+00	831+50	26,150	26,150	
	Cutoff Wall Only	G-2A	4	C1	1078+00	1096+00	1,800		
	Cutoff Wall Only	G-2A	5	C1	1098+10	1107+00	890		
	Cutoff Wall Only	G-2A	6	C1	1125+70	1129+99	429		
	Cutoff Wall Only	G-2A	7	C1	1130+20	1213+85	8,365	11,490	
	Cutoff Wall Only	G-2A	7	C2	1213+85	1429+00	21,515		
	Cutoff Wall Only	G-2A	8	C2	1451+50	1455+00	350		
	Cutoff Wall Only	G-2A	9	C2	1461+00	1608+50	14,750		
	Cutoff Wall Only	G-2A	10	C2	1624+70	1625+00	30		
	Cutoff Wall Only	G-2A	11	C2	1673+00	1673+30	30	36,680	
	Cutoff Wall Only	G-2A	12	D1	1766+00	1769+40	340		
	Cutoff Wall Only	G-2A	13	D1	1813+30	1900+50	8,720		
	Cutoff Wall Only	G-2A	14	D1	1903+50	2122+00	21,850	30,910	
	Cutoff Wall Only	G-2A	14	D2	2122+00	2290+00	16,800	16,800	147,570
5.2.3	Jet Grouting Cutoff Wall Only	G-2A	1	C1	1006+04	1007+90	186		
	Jet Grouting Cutoff Wall Only	G-2A	2	C1	1095+80	1098+30	250		
	Jet Grouting Cutoff Wall Only	G-2A	3	C1	1129+50	1130+67	117	560	
	Jet Grouting Cutoff Wall Only	G-2A	4	D1	1900+00	1904+00	400	400	960
5.2.4	Seepage Berm Only	G-2B	1	C1	1024+00	1027+50	350	350	
	Seepage Berm Only	G-2B	2	D2	2290+00	2303+00	1,300		
	Seepage Berm Only	G-2B	3	D2	2331+00	2368+00	3,700	5,000	5,350
5.2.5	Cutoff Wall with Full Levee Degrade and Existing Relief Wells	G-2D	1	C1	844+50	897+50	5,300	5,300	5,300
5.2.5	Cutoff Wall with Full Levee Degrade	G-2D	2	C2	1455+00	1461+00	600	600	600
5.2.6	Cutoff Wall with Existing Relief Wells	G-2C	1	B	512+00	545+00	3,300	3,300	
	Cutoff Wall with Existing Relief Wells	G-2C	3	C1	897+50	923+75	2,625	2,630	5,930
5.2.6	Cutoff Wall with New Relief Wells	G-2C	2	B	545+00	570+00	2,500	2,500	2,500
5.2.7	Cutoff Wall with Seepage Berm	G-2C	1	A	180+00	231+00	5,100		
	Cutoff Wall with Seepage Berm	G-2C	2	A	453+00	478+68	2,568	7,670	7,670

Table 5-1B Summary of Project Features for Alternative SB8

Engineering Appendix Paragraph	Measure	Typical Section (Plate)	Segment	Contract	Beg. STA of Measure	End. STA of Measure	Length per Segment (LF)	Length per Contract (LF)	Length per Measure (LF)
5.2.8	Cutoff Wall with Levee Relocation	G-2E	1	C2	1432+70	1451+50	1,880		
	Cutoff Wall with Levee Relocation	G-2E	2	C2	1608+50	1624+70	1,620		
	Cutoff Wall with Levee Relocation	G-2E	3	C2	1673+30	1674+37	107	3,610	
	Cutoff Wall with Levee Relocation	G-2E	3	D1	1674+37	1754+30	7,993	8,000	11,610
5.2.9	Cutoff Wall with Sutter Butte Canal Relocation	G-2F	1	C2	1429+00	1432+70	370	370	
	Cutoff Wall with Sutter Butte Canal Relocation	G-2F	2	D1	1754+30	1766+00	1,170	1,170	1,540
5.2.10	Cutoff Wall with Landside Toe Fill	G-2G	1	C1	1107+00	1125+70	1,870	1,870	1,870
5.2.11	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	1	A	230+00	250+00	2,000	2,000	
	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	2	C1	1125+00	1129+99	499		
	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	3	C1	1130+20	1151+50	2,130	2,630	
	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	4	C2	1224+00	1248+00	2,400	2,400	
	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	5	D1	1987+25	2002+00	1,475		
	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	6	D1	2016+75	2036+75	2,000		
	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	7	D1	2067+00	2088+00	2,100	5,580	
	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	8	D2	2137+00	2148+00	1,100		
	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	9	D2	2182+00	2196+50	1,450		
	DSM Cutoff Wall (already included in the Cutoff Wall Only section)	G-2A	10	D2	2245+75	2292+00	4,625	7,180	19,790
5.2.12	Erosion Protection	-	1	B	547+00	604+60	5,760	5,760	
	Erosion Protection	-	2	C2	1582+00	1601+00	1,900	1,900	7,660
5.2.13	Closure Structure (Stop Log)	-	1	C1	1130+00	1130+00	-	-	-

Table 5-2 Summary of Project Features for Alternative SB8

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
2A North	180+00 to 202+50	2,250	Cutoff wall with undrained seepage berm	180+00 to 202+50: 100 ft. wide undrained seepage berm. Seepage berm 5 ft. thick at berm toe. 180+00 to 202+50: Cutoff wall extending to an elevation of 25 ft.	
2B	202+50 to 218+66	1,616	Cutoff wall with undrained seepage berm	180+00 to 218+66: 100 ft. wide undrained seepage berm. Seepage berm 5 ft. thick at berm toe. 202+50 to 218+66: Cutoff wall extending to an elevation of 25 ft.	
3	218+66 to 300+66	8,200	Cutoff wall Cutoff wall with undrained seepage berm	218+66 to 231+00: 100 ft. wide undrained seepage berm. Seepage berm 5 ft. thick at berm toe. 218+66 to 230+00: Cutoff wall extending to an elevation of 25 ft. 230+00 to 250+00: Cutoff wall extending to an elevation of -35 ft. 250+00 to 289+00: Cutoff wall extending to an elevation of -20 ft. 289+00 to 300+66: Cutoff wall extending to an elevation of -12 ft.	
4	300+66 to 410+67	11,001	Cutoff wall	300+66 to 312+00: Cutoff wall extending to an elevation of -12 ft. 312+00 to 349+00: Cutoff wall extending to an elevation of 15 ft. 349+00 to 368+00: Cutoff wall extending to an elevation of 10 ft. 368+00 to 410+67: Cutoff wall extending to an elevation of 20 ft.	

Table 5-2 Summary of Project Features for Alternative SB8

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
5	410+67 to 478+68	6,801	Cutoff wall Cutoff wall with undrained seepage berm	453+00 to 478+00: 300 ft. wide undrained seepage berm. Seepage berm 5 ft. thick at berm toe. 410+67 to 417+00: Cutoff wall extending to an elevation of 20 ft. 417+00 to 425+00: Cutoff wall extending to an elevation of 10 ft. 425+00 to 456+00: Cutoff wall extending to an elevation of 15 ft. 456+00 to 475+35: Cutoff wall extending to an elevation of 15 ft. 475+35 to 478+68: Cutoff wall extending to an elevation of 15 ft.	
6 FIP	478+68 to 512+00	3,332	Cutoff wall	478+68 to 512+00: 65ft deep (from degrade line) cutoff wall.	
7	512+00 to 596+00	8,563	Cutoff wall Cutoff wall with existing and new relief wells Erosion Protection	512+00 to 514+00: 65ft deep (from degrade line) cutoff wall. 514+00 to 526+00: Cutoff wall tip elevation +15 feet 526+00 to 570+00: Cutoff wall tip elevation -5 feet 545+00 to 570+00: 22 new relief wells at 120 feet spacing and 50 feet depth (including new concrete lined V-ditch). 570+00 to 575+00: Cutoff wall tip elevation -5 feet 575+00 to 595+00: Cutoff wall tip elevation -10 feet 595+00 to 596+00: Cutoff wall tip elevation +15 feet 547+00 to 596+00: High Performance Turf Reinforce Mat (HPTRM)	512+00 to 545+00: existing seepage interceptor system (24 relief wells, ditch and pump station) are to remain.
8	596+00 to 654+75	5,875	Cutoff wall Erosion Protection	596+00 to 654+75: Cutoff wall tip elevation +15 feet 596+00 to 604+60: High Performance Turf Reinforce Mat (HPTRM)	

Table 5-2 Summary of Project Features for Alternative SB8

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
9	654+75 to 706+50	5,175	Cutoff wall	654+75 to 670+00: Cutoff wall tip elevation +15 feet 670+00 to 697+00: Cutoff wall tip elevation +20 feet 697+00 to 706+50: Cutoff wall tip elevation -10 feet	
10	706+50 to 774+00	6750	Cutoff wall	706+50 to 726+00: Cutoff wall tip elevation -10 feet 726+00 to 746+00: Cutoff wall tip elevation -5 feet 746+00 to 754+50: Cutoff wall tip elevation +5 feet 754+50 to 774+00: Cutoff wall tip elevation +25 feet	
11	774+00 to 830+00	5,600	Cutoff wall	774+00 to 784+50: Cutoff wall tip elevation +25 feet 784+50 to 827+50: Cutoff wall tip elevation -5 feet 827+50 to 830+00: Cutoff wall tip elevation +25 feet	
12	830+00 to 845+00	1,500	No proposed rehabilitation measure with exception below Cutoff wall (transition only, at both ends of this reach)	830+00 to 831+50: Cutoff wall tip elevation +25 feet (transition only) 844+50 to 845+00: Cutoff wall tip elevation -26 feet (transition only)	829+85 to 845+25: existing cutoff wall (23.5ft deep, tip elevation 30.5)
13	845+00 to 927+00	8,200	Cutoff wall Cutoff wall with full levee degrade and existing relief wells	844+50 to 897+50: Full levee degrade and re-construction 844+50 to 849+00: Cutoff wall tip elevation -20’ to -29’ 848+00 to 863+00: Cutoff wall tip elevation -29’ 863+00 to 877+00: Cutoff wall tip elevation -30’ 877+00 to 887+00: Cutoff wall tip elevation -31’ 887+00 to 893+00: Cutoff wall tip elevation -30’ 893+00 to 897+50: Cutoff wall tip elevation -29’ 897+50 to 923+75: Cutoff wall tip elevation +25’	844+50 to 897+50: Existing seepage interceptor system (52 relief wells, ditch and pump stations) are to remain. 897+50 to 923+75: Existing seepage interceptor system (29 relief wells, ditch and pump stations) are to remain. 923+23 to 927+00: existing cutoff wall (32.5ft deep, tip elevation 42.5)

Table 5-2 Summary of Project Features for Alternative SB8

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
14	927+00 to 954+40	2,740	No proposed rehabilitation measure	---	927+00 to 954+40: existing cutoff wall (32.5ft deep, tip elevation 42.5) No as-built drawing available for the existing cutoff wall.
15	954+40 to 968+50	1,410	No proposed rehabilitation measure	---	954+40 to 968+50: existing cutoff wall (32.5ft deep, tip elevation 42.5) No as-built drawing available for the existing cutoff wall.

Table 5-2 Summary of Project Features for Alternative SB8

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
16	968+50 to 1080+00	11,150	Jet grouting cutoff wall at 5th Street bridge crossing. Toe berm at 10th Street bridge crossing. Cutoff wall (transition only, at the end of Reach 16 to overlap existing cutoff wall).	1006+04 to 1007+90 (5th Street bridge crossing): Jet grouting cutoff wall tip elevation +40 feet 1023+90 to 1027+50 (10th Street bridge crossing): Toe berm, 23 feet wide, approximately 7 feet thick at the levee toe, 4H:1V slope at toe berm. 1077+85 to 1080+00: Cutoff wall tip elevation +30 feet and backfill landside toe depression (transition only).	968+50 to 983+23: existing cutoff wall (32.5ft deep, tip elevation 42.5) 983+23 to 996+23: existing cutoff wall (22.5ft deep, tip elevation 52.5) 996+23 to 1006+24: existing cutoff wall (32.5ft deep, tip elevation 42.5) 1007+90 to 1015+70: existing cutoff wall (32.5ft deep, tip elevation 42.5) 1015+70 to 1024+42: existing cutoff wall (43ft deep, tip elevation 35) 1026+99 to 1079+66: existing cutoff wall (39ft deep, tip elevation 38)

Table 5-2 Summary of Project Features for Alternative SB8

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
17	1080+00 to 1130+86	5,086	Cutoff wall Jet grouting cutoff wall at Yuba city water treatment plant Jet grouting cutoff wall at Railroad North of Yuba City Landside toe depression filled Closure Structure	1107+00 to 1125+70: Backfill landside toe depression 1080+00 to 1089+00: Cutoff wall tip elevation +30 feet 1089+00 to 1096+00: Cutoff wall tip elevation +35 feet 1095+80 to 1098+30: Jet grouting cutoff wall tip elevation +35 feet 1098+10 to 1125+00: Cutoff wall tip elevation +35 feet 1125+00 to 1129+99: Cutoff wall tip elevation +0 feet 1129+50 to 1130+67: Jet grouting cutoff wall tip elevation +0 feet 1130+20 to 1130+86: Cutoff wall tip elevation +0 feet 1130+00: Stop log closure structure or equivalence	
18	1130+86 to 1213+85	8,299	Cutoff wall	1130+86 to 1151+50: Cutoff wall tip elevation +0 feet 1151+50 to 1159+50: Cutoff wall tip elevation +30 feet 1159+50 to 1169+50: Cutoff wall tip elevation +25 feet 1169+50 to 1189+50: Cutoff wall tip elevation +30 feet 1189+50 to 1209+50: Cutoff wall tip elevation +40 feet 1209+50 to 1213+85: Cutoff wall tip elevation +35 feet	
19	1213+85 to 1297+83	8,398	Cutoff wall	1213+85 to 1219+75: Cutoff wall tip elevation +35 feet 1219+75 to 1224+00: Cutoff wall tip elevation +5 feet 1224+00 to 1238+00: Cutoff wall tip elevation -28 feet 1238+00 to 1248+00: Cutoff wall tip elevation -42 feet 1248+00 to 1268+75: Cutoff wall tip elevation +3 feet 1268+75 to 1297+83: Cutoff wall tip elevation +35 feet	
20	1297+83 to 1374+33	7,650	Cutoff wall	1297+83 to 1298+75: Cutoff wall tip elevation +35 feet 1298+75 to 1359+00: Cutoff wall tip elevation +50 feet 1359+00 to 1369+00: Cutoff wall tip elevation +40 feet 1369+00 to 1374+33: Cutoff wall tip elevation +32 feet	

Table 5-2 Summary of Project Features for Alternative SB8

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
21	1374+33 to 1433+83	5,950	Cutoff wall Levee relocation with cutoff wall (transition only) Canal relocation	1374+33 to 1386+50: Cutoff wall tip elevation +32 feet 1386+50 to 1408+50: Cutoff wall tip elevation +55 feet 1408+50 to 1433+83: Cutoff wall tip elevation +40 feet 1432+50 to 1433+83: Levee relocation (20ft riverward, transition only) 1429+00 to 1433+83 Sutter Butte Main Canal relocation.	
22	1433+83 to 1503+83	7,000	Cutoff wall Cutoff wall with full levee degrade Levee relocation with cutoff wall	1433+83 to 1450+00: Levee relocation (20ft riverward) 1451+50 to 1451+50: Levee relocation (20ft riverward, transition only) 1455+00 to 1461+00: Full levee degrade and re-construction 1433+83 to 1448+75: Cutoff wall tip elevation +40 feet 1448+75 to 1468+83: Cutoff wall tip elevation +50 feet 1468+83 to 1503+83: Cutoff wall tip elevation +55 feet	Full levee degrade and reconstruction recommended for a portion of this reach due to severe animal burrowing
23	1503+83 to 1609+37	10,554	Cutoff wall Levee relocation with cutoff wall (transition only) Erosion Protection	1503+83 to 1508+50: Cutoff wall tip elevation +55 feet 1508+50 to 1528+75: Cutoff wall tip elevation +60 feet 1528+75 to 1566+50: Cutoff wall tip elevation +55 feet 1566+50 to 1608+75: Cutoff wall tip elevation +60 feet 1608+50 to 1609+37: Levee relocation (20ft riverward, transition only) 1582+00 to 1601+00: High Performance Turf Reinforce Mat (HPTRM)	
24	1609+37 to 1623+86	1,449	Cutoff wall Levee relocation with cutoff wall	1609+37 to 1612+00: Levee relocation (20ft riverward, transition only) 1612+00 to 1623+00: Levee relocation (20ft riverward) 1623+00 to 1623+86: Levee relocation (20ft riverward, transition only) 1608+75 to 1623+86: Cutoff wall tip elevation +28 feet	

Table 5-2 Summary of Project Features for Alternative SB8

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
25	1623+86 to 1674+37	5,051	No proposed rehabilitation measure with exception below Cutoff wall (transition only, at both ends of this reach) Levee relocation with cutoff wall (transition only)	1623+86 to 1624+50: Levee relocation (20ft riverward, transition only) 1623+86 to 1625+00: Cutoff wall tip elevation +28 feet (transition only) 1673+00 to 1674+37: Cutoff wall tip elevation +65 feet (transition only) 1673+00 to 1674+37: Levee relocation (20ft riverward, transition only)	
26	1674+37 to 1707+11	3,274	Cutoff wall Levee relocation with cutoff wall	1674+37 to 1675+00: Levee relocation (20ft riverward, transition only) 1675+00 to 1707+11: Levee relocation (20ft riverward) 1674+37 to 1707+11: cutoff wall tip elevation +65 feet	Cutoff wall tip elevations to be confirmed by additional exploration (planned)
27	1707+11 to 1721+60	1,449	Cutoff wall Levee relocation with cutoff wall	1707+11 to 1721+60: Levee relocation (20ft riverward) 1707+11 to 1721+60: cutoff wall tip elevation +65 feet	Cutoff wall tip elevations to be confirmed by additional exploration (planned)
28	1721+60 to 1769+31	4,771	Cutoff wall Canal relocation Levee relocation with cutoff wall	1721+60 to 1753+00: Levee relocation (20ft riverward) 1753+00 to 1754+50: Levee relocation (20ft riverward, transition only) 1752+00 to 1766+00: Sutter Butte Main Canal Relocation 1721+60 to 1727+75: cutoff wall tip elevation +65 feet 1727+75 to 1748+50: cutoff wall tip elevation +75 feet 1748+50 to 1769+31: cutoff wall tip elevation +45 feet	Cutoff wall tip elevations to be confirmed by additional exploration (planned)
29	1769+31 to 1813+33	4,402	No proposed rehabilitation measure	---	No proposed rehabilitation measure as existing conditions meet criteria

Table 5-2 Summary of Project Features for Alternative SB8

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
30	1813+33 to 1902+00	8,867	Cutoff wall Jet grouting cutoff wall	1813+33 to 1816+50: cutoff wall tip elevation +80 feet 1816+50 to 1848+25: cutoff wall tip elevation +30 feet 1848+25 to 1866+00: cutoff wall tip elevation +70 feet 1866+00 to 1877+75: cutoff wall tip elevation +47 feet 1877+75 to 1883+00: cutoff wall tip elevation +40 feet 1883+00 to 1900+50: cutoff wall tip elevation +27 feet 1900+00 to 1902+00: jet grouting cutoff wall tip elevation +27 feet	Waterside slope maintenance to address sloughing of steep channel bank slopes may be required in the future.
31	1902+00 to 1958+00	5,600	Cutoff wall Jet grouting cutoff wall	1902+00 to 1904+00: jet grouting cutoff wall tip elevation +27 feet 1903+50 to 1907+50: cutoff wall tip elevation +27 feet 1907+50 to 1917+50: cutoff wall tip elevation +44 feet 1917+50 to 1927+50: cutoff wall tip elevation +75 feet 1927+50 to 1937+00: cutoff wall tip elevation +50 feet 1937+00 to 1958+00: cutoff wall tip elevation +40 feet	
32	1958+00 to 1989+00	3,100	Cutoff wall	1958+00 to 1971+00: cutoff wall tip elevation +40 feet 1971+00 to 1987+25: cutoff wall tip elevation +48 feet 1987+25 to 1989+00: cutoff wall tip elevation +10 feet	
33	1989+00 to 2122+00	13,300	Cutoff wall	1989+00 to 2002+00: cutoff wall tip elevation +10 feet 2002+00 to 2016+75: cutoff wall tip elevation +90 feet 2016+75 to 2036+75: cutoff wall tip elevation +20 feet 2036+75 to 2041+00: cutoff wall tip elevation +53 feet 2041+00 to 2067+00: cutoff wall tip elevation +38 feet 2067+00 to 2088+00: cutoff wall tip elevation +33 feet 2088+00 to 2122+00: cutoff wall tip elevation +90 feet	

Table 5-2 Summary of Project Features for Alternative SB8

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
34	2122+00 to 2182+00	6,000	Cutoff wall	2122+00 to 2137+00: cutoff wall tip elevation +90 feet 2137+00 to 2148+00: cutoff wall tip elevation +20 feet 2148+00 to 2164+00: cutoff wall tip elevation +90 feet 2164+00 to 2182+00: cutoff wall tip elevation +50 feet	
35	2182+00 to 2224+00	4,200	Cutoff wall	2182+00 to 2196+50: cutoff wall tip elevation +40 feet 2196+50 to 2212+00: cutoff wall tip elevation +45 feet 2212+00 to 2218+25: cutoff wall tip elevation +50 feet 2218+25 to 2224+00: cutoff wall tip elevation +55 feet	
36	2224+00 to 2259+00	3,500	Cutoff wall	2224+00 to 2233+50: cutoff wall tip elevation +55 feet 2233+50 to 2258+25: cutoff wall tip elevation +70 feet 2258+25 to 2259+00: cutoff wall tip elevation +42 feet	
37	2259+00 to 2290+00	3,100	Cutoff wall	2259+00 to 2277+00: cutoff wall tip elevation +42 feet 2277+00 to 2290+00: cutoff wall tip elevation +45 feet	
38	2290+00 to 2303+00	1,300	Seepage berm Seepage berm with cutoff wall (transition only, extend from Reach 37 into Reach 38,)	2290+00 to 2303+00: Seepage berm up to 11 foot high that extends horizontally at elevation 200 year + 4 feet for a distance of 50 feet from the landside slope of the levee before tapering to a height of 3 feet at the berm toe at a distance of 170 feet from the centerline of the existing levee. 2290+00 to 2292+00: Cutoff wall with tip elevation of +45 feet to (transition only).	Grading work to generate a level platform area will be required prior to construction of seepage berm
39	2303+00 to 2319+00	1,600	No proposed rehabilitation measure	---	No as-built drawing available for the existing cutoff wall.
40	2319+00 to 2359+00	4,000	Seepage Berm	2319+00 to 2331+00: No mitigation measure 2331+00 to 2335+00: Seepage berm 120 feet wide, 9 feet thick at the levee toe and 3 feet at the berm toe 2335+00 to 2359+00: Seepage berm 100 feet wide, 9 feet thick at the levee toe and 3 feet at the berm toe	Grading work to generate a level platform area will be required prior to construction of seepage berm

Table 5-2 Summary of Project Features for Alternative SB8

Reach	Stationing	Length (feet)	Rehabilitation Measure(s)	Approximate Dimensions of Primary Features	Comments
41	2359+00 to 2368+00	900	Seepage berm with filter drain	2359+00 to 2368+00: Seepage berm 100 feet wide, 5 feet thick at levee toe with a 1 foot thick filter layer (ASTM C33 fine aggregate) at bottom and across seepage berm. Seepage berm thickness of 5 feet includes 1 foot of filter layer and 4 feet of seepage berm material at levee toe. A geotextile separator, compatible with ASTM C33 fine aggregate, should be placed on top of the ASTM C33 fine aggregate layer.	Near Thermalito Afterbay dam and outfall facility and old Sutter Butte Canal channel

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
		2371+00			Hamilton Bend Levee Transition	Seepage berm			
	41	2368+00			End Reach 41	Seepage berm			
1	41	2365+00			To construct After bay River Outlet and dredge tailing training dike.	Seepage berm		Struc	
2	41	2359+58	2,291,802.63	6,663,263.33	Old Sutter Butte Head Works Levee North	Seepage berm	The structure does not meet title 23 requirements. **Recommend Complete Removal**	IR(G)	
3	41	2359+57	2,291,800.70	6,663,265.27	Old Sutter Butte Head Works North	Seepage berm		IR(G)	
4	41	2359+07	2,291,752.42	6,663,249.77	Old Sutter Butte Head Works South	Seepage berm		IR(G)	
5	41	2359+05	2,291,752.84	6,663,244.36	Old Sutter Butte Head Works Levee South	Seepage berm		IR(G)	
	40/41	2359+00			Reach 40/41 Transition	Seepage berm			
6	40	2352+90	2,291,166.67	6,663,263.09	12 kv overhead electrical power line crossing	Seepage berm	**Relocate outside of of the proposed right-of-way.**	EL	OH
7	40	2352+80			24 Inch CM pipe through levee. Concrete saddle and apron with Calco Slide gate.	Seepage berm	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SD(G)	
8	40	2345+79	2,290,475.75	6,663,109.16	10 inch Iron Pipe through levee that appears to be abandoned	Seepage berm	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(P)	12.7
	39/40	2319+00			Reach 39/40 Transition	No Rehabilitation Required			
9	39	2312+05			24 Inch CM pipe through levee. Concrete saddle and apron with Calco automatic drainage gate.	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SD(G)	
	38/39	2303+00			Reach 38/39 Transition	Seepage berm			
10	38	2301+00			To excavate dredger tailings from the right bank of the Feather River. The tailings are to be excavated from an area approximately 100 feet landward of the landward levee toe. **The application was deemed incomplete on 8-4-98.**	Seepage berm		Struc	
	37/38	2290+00			Reach 37/38 Transition	Cutoff wall			
	37	2285+00			Maintenance Area 07 / Hamilton Bend Levee Transition	Cutoff wall			
11	37	2283+65	2,285,659.90	6,661,586.51	24 Inch CM pipe through levee. Concrete saddle and apron with Calco automatic drainage gate.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	15.0
12	37	2283+44	2,285,640.25	6,661,593.28	24 Inch reinforced concrete encased CM irrigation pipe through levee. Slide Gate in 36 inch CM pipe riser on the waterside slope. 8 inch Irrigation pipe ran through existing pipe, pipe ends not exposed	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR (G)	17.3
13	37	2282+57	2,285,558.49	6,661,622.35	12 kv overhead electrical power line crossing	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
14	37	2281+75			Stairs and 1 Inch Domestic Water Line. Information Provided by Owner. Supplies water the Hauler.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	DW (P)	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
15	37	2274+95	2,284,812.04	6,661,741.46	24 Inch CM pipe through levee. Automatic drainage gate on waterside outlet, headwall on land side inlet. Both ends of the pipe have been cleared to operate.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	17.8
16	37	2274+86	2,284,802.77	6,661,742.00	24 Inch CM reinforced concrete encased drainage pipe through levee. Slide Gate in 36 inch CM pipe riser on the waterside slope. Neither pipe end located or exposed.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR (G)	21.8
17	37	2268+27	2,284,144.45	6,661,772.03	24 Inch reinforced concrete encased CM irrigation pipe through levee. Slide Gate in 36 inch CM pipe riser on the waterside slope with waterside outlet broken off and plugged.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(G)	18.4
18	37	2265+50	2,283,868.22	6,661,784.45	12 kv overhead electrical power line crossing	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
19	37	2262+69	2,283,587.31	6,661,797.10	24 Inch CM drain pipe through levee with landside headwall. Automatic Drainage Gate on the waterside end with splash pan and saddle headwall.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	18.0
20	37	2262+14	2,283,532.17	6,661,800.26	Road Across Levee North	Cutoff Wall		Road	
21	37	2261+90	2,283,505.66	6,661,801.21	Road Across Levee South	Cutoff Wall		Road	
22	37	2261+56	2,283,474.37	6,661,801.73	Propane tank at landside toe	Cutoff Wall	**Recommended Removal**	struc	
23	37	2261+11	2,283,429.45	6,661,804.82	Propane tank at landside toe	Cutoff Wall	**Recommended Removal**	struc	
24	37	2260+55	2,283,374.22	6,661,809.27	24 Inch CM pipe through levee. Concrete saddle and apron with Calco automatic drainage gate.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	18.1
	36/37	2259+00			Reach 36/37 Transition	Cutoff wall			
25	36	2256+94	2,283,026.77	6,661,894.43	24 Inch CM pipe through levee. Concrete saddle and apron with Calco automatic drainage gate.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	17.1
26	36	2256+71	2,283,007.16	6,661,905.92	24 Inch reinforced concrete encased CM irrigation pipe through levee. Slide Gate in 36 inch CM pipe riser on the waterside slope. Neither pipe end located or exposed.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(G)	19.1
27	36	2270+00			To construct a 50 x 100 foot walnut processing building in the right overflow area of the Feather River	Cutoff Wall		Struc	
28	36	2250+76	2,282,559.01	6,662,297.09	24 Inch CM irrigation pipe through levee. Slide gate in 36 inch CM pipe riser on the waterside slope and slide gate in 48 inch RCP standpipe on landside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(G)	16.4
~~29~~	~~36~~	~~2250+10~~	~~2,282,509.99~~	~~6,662,339.63~~	~~Concrete structure in waterside slope of levee Removed~~	~~Cutoff Wall~~		~~struc~~	
30	36	2248+30	2,282,389.90	6,662,473.42	Underground telephone cable through levee at south side of paved road over levee	Cutoff Wall	Not sure if the conduit meets title 23 or 200 WSEL requirements. **Replace in accordance with USACE standard**	TL	
31	36	2245+52	2,282,232.77	6,662,702.59	24 Inch CM drain pipe through levee. Automatic Drainage Gate on the waterside end buried and not located.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	15.1

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
32	36	2239+66	2,281,676.83	6,662,766.65	24 Inch CM drain pipe through levee. Concrete headwall at both toes and automatic Drainage Gate in 36 inch concrete standpipe on berm. House near land toe, land end not located it could possibly be in house back yard.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	15.8
33	36				Excavation into toe of levee with cuts up to 4.5 feet high and near 1:1. The CVFPB sent an encroachment violation notice on August 17, 2011 to Deane and Edith Williams Trust.	Cutoff Wall		Struc	
	35/36	2224+00			Reach 35/36 Transition	Cutoff wall			
34	35	2216+71	2,280,223.64	6,663,692.84	12 Kv power line crossing of levee. One pole 215 feet water ward of levee toe with overhead clearance of 27 feet.	Cutoff Wall		EL	OH
35	35	2208+56	2,279,495.37	6,664,025.97	Irrigation well located near landside toe. Use temporary pipe to pump over levee. No standpipe and no permanent pipe over levee. Well Approx 10 feet from landside toe	Cutoff Wall	The temporary pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(G)	
36	35	2201+87	2,279,440.81	6,664,690.55	Abandoned 10 inch reinforced concrete encased steel irrigation pipe through levee. Slide gate in 24 inch concrete standpipe at the waterside toe. Pipe ends not located or exposed.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(G)	13.1
37	35	2182+45	2,277,864.11	6,665,182.53	Power pole at land side toe	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
	34/35	2182+00			Reach 34/35 Transition	Cutoff wall			
38	34	2178+48	2,277,831.66	6,665,565.26	To replace an existing buried telephone cable with aerial cable crossing of the right bank of the Feather River at the end of Cherry Road. The aerial telephone will be placed on an existing PG&E poles. Due to two right angle bends in the levee, the overhead cable will cross the levee crown at two locations within the extension	Cutoff Wall		EL	OH
39	34	2178+39	2,277,825.68	6,665,571.75	16 inch steel irrigation pipe through levee. Slide gate in 36 inch concrete standpipe at the waterside toe. Concrete distribution box at the landside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(G)	13.2
40	34				Excavation into toe of levee with cuts up to 3.5 feet high and near vertical around irrigation standpipes. The CVFPB sent an encroachment violation notice on September 12, 2011 to James Banes Ranch.	Cutoff Wall		Struc	
41	34				Excavation into toe of levee with cuts up to 3 feet high and near vertical. The CVFPB sent an encroachment violation notice on September 30, 2011 to Banes Family Trust.	Cutoff Wall		Struc	
42	34				Excavation into toe of levee with cuts up to 3 feet high. The CVFPB sent an encroachment violation notice on September 12, 2011 to James Banes Ranch.	Cutoff Wall		Struc	
43	34				Excavation into toe of levee with cuts up to 5 feet high and sloped 1:1. The CVFPB sent an encroachment violation notice on July 28, 2011 to Clinton & Gail Moffitt.	Cutoff Wall		Struc	
44	34				Excavation into toe of levee with cuts 3 to 5 feet high and sloped 1:1. The CVFPB sent an encroachment violation notice on July 28, 2011 to Clinton & Gail Moffitt.	Cutoff Wall		Struc	
45	34	2138+22	2,275,157.46	6,664,140.19	Power line crossing of levee and guy wire	Cutoff Wall		EL	OH
46	34	2127+33			To authorize an existing 2 inch irrigation pipeline through the right bank of the Feather Rivers. Removable pipe over levee found at 2120+50	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(P)	2.0
47	34				Excavation into toe of levee with near vertical cut up to 5 feet high. The CVFPB sent an encroachment violation notice on July 28, 2011 to Rodney Hodges.	Cutoff Wall		Struc	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
	33/34	2122+00			Reach 33/34 Transition	Cutoff wall			
48	33				Approximately 300 feet of excavation along the landside and waterside levee toe with cuts up to three (3) feet high. The CVFPB sent an encroachment violation notice on July 28, 2011 to Rodney Hodges.	Cutoff Wall		Struc	
49	33				Excavation into toe of levee from up to 3 feet high. The CVFPB sent an encroachment violation notice on July 28, 2011 to Rodney Hodges.	Cutoff Wall		Struc	
50	33				To plant a Kiwi vineyard parallel to the direction of river flow with a minimum row spacing of 4.9 meters and 2.4 meters spacing within each row.	Cutoff Wall		Trees	
51	33	2092+90	2,272,415.47	6,665,972.41	Underground telephone cable through levee on north side of paved road over the top of the levee.	Cutoff Wall	The cable may not meet title 23 requirements. **Replace in accordance with USACE standard**	TL	
52	34	2092+37			Power line crossing of levee on south side of road	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
53	33	2092+70			5" aluminum irrigation pipe through levee.	Cutoff Wall		IR(P)	
54	33	2084+03	2,271,531.48	6,666,011.72	5" x 0.25" wall steel irrigation line through levee	Cutoff Wall	The pipeline does meets title 23 requirements and but does not have a positive shut-off structure or anti-siphon installed. **Replace in accordance with USACE standard**	IR(P)	2.2
55	33				Excavation into toe of levee from 1 to 3 feet high. The CVFPB sent an encroachment violation notice on July 27, 2011 to Jagdeep Sandu.	Cutoff Wall		Struc	
56	33				To slope and revet 2000 feet of the right bank of Feather River and to eliminate obstructions in the channel	Cutoff Wall		struc	
57	33	2037+15	2,268,425.64	6,666,455.64	Palermo-Peachton 115kv Crossing. To construct, operate, and maintain a 115 kv transmission line crossing the Feather River. The 115 kv line replaced and existing 60 kv line. No record of the 60 kv permit.	Cutoff Wall		EL	OH
58	33	2032+90			12 inch reinforced concrete encased steel irrigation pipe through levee. Slide gate in 24 inch concrete standpipe at waterside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(G)	14.0
59	33	2029+00			Four (4) areas of excavation into the levee toe at tree locations. Cuts up to 3.5 feet high. The CVFPB sent an encroachment violation notice on July 28, 2011 to Betty Chambers.	Cutoff Wall		Struc	
60	33	2026+40			12 inch reinforced concrete encased steel irrigation pipe through levee. Slide gate in 24 inch concrete standpipe at waterside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(G)	13.5
61	33	2020+81	2,267,049.65	6,665,590.75	Large steel tank on land side at toe of levee	Cutoff Wall	**Recommended Removal**		
62	33	2018+00			To retain a spur levee between the right bank project levee and the bank of the low water channel, a distance of approximately 600 feet. The spur levee is normal to the project levee and to the direction of the overbank flow. The levee varies from 3 to 6 feet above ground surface	Cutoff Wall		Struc	
63	33	2017+78	2,266,812.83	6,665,317.53	22 inch reinforced concrete encased steel irrigation pipe through levee. Slide gate in 36 inch concrete standpipe at waterside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR (G)	13.9

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
64	33	2013+00			Over steepended horizontal vertical levee slope 1:1 excavation at levee toe with cuts up to 5 feet high. The CVFPB sent an encroachment violation notice on July 28, 2011 to Robert Magenheimer.	Cutoff Wall		Struc	
65	33	2006+05			Irrigation well located near about 10 feet from landside toe.	Cutoff wall	**Relocate outside of of the proposed right-of-way.**	well	
66	33	2004+86	2,265,846.14	6,664,564.55	7 inch steel pipe sleeved through the existing 12 inch steel pipe through levee. The annular space between the two pipes is plugged with concrete on both ends. Slide gate in concrete risers on both ends.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(P)	AG
67	33	2007+00			To construct 1255 feet of spur levee from west project levee to the Feather River west bank.	Cutoff Wall		Struc	
68	33	2001+00			Over steepended levee slope and a 4 foot high long cut excavation at the levee toe. Levee slope at toe cut is 1:1 or steeper. Tree encroachment also noted by State. The CVFPB sent an encroachment violation notice on July 27, 2011 to Jack Mariani.	Cutoff Wall		Struc	
69	33	1995+00			To authorize a pear orchard on the west bank overflow area of the Feather River.	Cutoff Wall		trees	
70	33	1995+00			To authorize an existing walnut orchard on the right bank overflow area of the Feather River/	Cutoff Wall		trees	
	32/33	1989+00			Reach 32/33 Transition	Cutoff wall			
71	32	1970+00			To interplant trees in an existing pear orchard on the right bank overflow area of the Feather River	Cutoff wall		trees	
72	32	1961+03	2,264,727.12	6,660,794.20	Double 60 Inch Storm Drainage Pipes through levee. Waterside headwall with automatic drainage gates. Landside headwall within toe of levee. No positive shut-off valve.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	20.0
73	32	1959+00			Unpermitted excavation at the toe of the levee with cuts up to 5 feet high; 1:1 cut slopw at the levee toe. The CVFPB sent an encroachment violation notice on October 4, 2011 to David Henderson Trust.	Cutoff wall		struc	
	31/32	1958+00				Cutoff wall			
74	31	1957+75	2,264,471.77	6,660,429.36	To construct a earthen Berm, equipment storage shed, labor apartment and multiple-purpose building on the landward berm of the levee. The 32 foot by 34 foot building will be located adjacent to an existing shop building. The proposed building will be located on an existing earth fill located on landward slope of the levee and will be 10 feet from the toe of the levee.	Cutoff wall		Struc	
75	31	1956+20	2,264,512.56	6,660,422.66	24 inch CM irrigation pipe through levee. Slide gate in concrete riser pipe on landside berm. Pipe runs under mobile home.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(G)	11.0
76	31	1956+10			Modular Home Located on the Levee Top	Cutoff wall	**Recommended Removal**	struc	
77	31				Unpermitted excavation at the levee toe consisting of cuts up to 2 vertical feet. The CVFPB sent an encroachment violation notice on September 20, 2011 to Bassi & Dhillon, Inc.	Cutoff wall		struc	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
78	31	1947+33	2,263,626.47	6,660,477.81	Service pole 10' from water side toe with 3" steel conduit through top of levee	Cutoff wall	**Relocate pole outside of of the proposed right-of-way. Replace conduit in accordance with USACE Standard**	EL	
79	31	1934+54	2,262,349.20	6,660,521.29	24 inch steel pipe through levee. Slide gate in concrete box on the water side slope. (Corps list pipe as 36 inch CMP)	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard.**	SD(G)	17.5
80	31	1906+58			To authorize construction of stream gauging station on the right bank levee of the Feather River	Cutoff wall		Struc	
81	31	1906+58	2,259,711.16	6,661,315.13	12 kv Pole line over levee. One pole 10 foot landward and one pole on levee for DWR and service electrical to water side building	Cutoff wall		EL	OH
82	31	1903+96	2,259,482.14	6,661,442.38	To extend 3 phase No. 4 ACSR 12 kv pole line across right bank levee of the Feather River. Line to provide power to new pump for Roy Mathews	Jet Grouting		EL	OH
83	31	1902+50			For construction of a temporary fill from the left bank Feather River to a gravel bar and to excavate a channel through bar	Jet Grouting		Struc	
84	31	1902+19	2,259,338.81	6,661,543.33	Oroville-Gridley Highway Bridge Upstream	Jet Grouting		Bridge	
85	31				Open channel on land side of levee at toe	Jet Grouting	**Relocate outside of of the proposed right-of-way.**	IR(G)	
	30/31	1902+00			Reach 30/31 Transition	Jet Grouting			
86	30	1901+79	2,259,317.57	6,661,574.18	Oroville-Gridley Highway Bridge Downstream	Jet Grouting		Bridge	
87	30	1900+82	2,259,239.50	6,661,630.24	Power pole at land side toe	Jet Grouting	**Relocate outside of of the proposed right-of-way.**	EL	OH
88	30	1893+60			3/4 inch galvanized iron waterline through levee	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	WL	3.1 rd
89	30	1893+20	Not Verified		6 inch concrete encased cast iron sewer pipe through levee	Cutoff wall	**Replace in accordance with USACE standard.**	SS (G)	13.9 rd
90	30	1892+60	Not Verified		6 inch concrete encased cast iron sewer pipe through levee	Cutoff wall	**Replace in accordance with USACE standard.**	SS (G)	13.8 rd
91	30	1892+20	Not Verified		Two 4 inch concrete encased cast iron sewer lines through the levee. The Discharge end connected to the CM pump house at the landside toe of the bow levee.	Cutoff wall	**Replace in accordance with USACE standard.**	SS(P)	1.5 rd
92	30	1892+89	2,258,542.19	6,662,052.68	Pole line over the levee.	Cutoff wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
93	30	1891+25	2,258,506.36	6,662,137.72	Pole line over the levee.	Cutoff wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
94	30	1888+70	2,258,285.10	6,662,367.26	To extend 3 phase No. 4 ACSR 12 kv pole line across right bank levee of the Feather River. Line to provide power to new pump for Roy Mathews	Cutoff wall		EL	OH
95	30	1888+50	2,258,298.89	6,662,410.71	To expand an existing waste water treatment facility on the left bank of the Feather River and to install a 6 inch force main along the right bank levee of the Feather River/	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SS(P)	2.5 rd

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
96	30	1887+29	2,258,210.65	6,662,463.86	12 kv power line crossing of levee	Cutoff wall		EL	OH
97	30	1868+17			Butte County Drainage District No. 1. An 18-Inch pipe through Levee.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SD(G)	
98	30	1828+00			To plant a walnut and peach orchard on the right bank overflow area of the Feather River between LM 2.82 - 3.08 and LM 3.37 - 3.69.	Cutoff wall		Trees	
99	30	1849+80	2,255,332.08	6,664,793.22	18 inch cast iron sewer pipe through levee. Concrete thrust block for cutoff walls on both shoulders. Siphon breaker in concrete pipe riser on the waterside shoulder.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SS(P)	2.8 rd
100	30	1834+42	2,254,466.85	6,665,951.72	24 inch CM drainage pipe through levee. Automatic drainage gate on waterside toe. 12 inch pipe sleeved through 24 inch pipe.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR (G)	12.5
101	30	1828+00			To plant a walnut and peach orchard on the right bank overflow area of the Feather River between LM 2.82 - 3.08 and LM 3.37 - 3.69.	Cutoff wall		Trees	
102	30	1823+01	2,253,380.39	6,666,199.22	12 Inch cement coated and lined steel sewer pipe sleeved through the existing 24 inch CM pipe. Annular space pressure grouted.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SS (G)	21.8
103	30	1818+72	2,252,948.28	6,666,209.81	24 Inch CM pipe through levee. Slide gate in 36 inch CM riser on the waterside slope.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SS (G)	25.2
104	30				Sewer Ponds located within 30' of both toes of the levee	Cutoff wall		struc	
105	30	1816+63	2,252,738.86	6,666,205.04	City of Gridley. To install approximately 660 feet of chain link fence on the waterside toe and to authorize approximately 600 feet of 6 foot high chain link fence on the landside toe of the right bank levee of the Feather River.	Cutoff wall		struc	
106	30	1815+00			City of Gridley. To operate a sand borrow pit and gravel borrow pit within the Feather River Designated Floodway, located on the right bank overflow of the Feather River.	Cutoff wall		struc	
107	30	1814+00			To fill an eroded area along the right bank of the Feather River with concrete rubble and old tire wire. The eroded area is approximately 250 feet long and extends into the bank for a distance of 120 feet	Cutoff wall		struc	
108	30	1813+70			24 Inch CM pipe through levee. Concrete saddle and apron with Calco Slide gate.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SD(G)	
	29/30	1813+33			Reach 29/30 Transition	Cutoff wall			
109	29	1809+65	2,252,095.81	6,666,415.94	24 Inch CM pipe through levee. Automatic drainage gate on waterside propped open and concrete headwall on land side. The CVFPB sent an encroachment violation notice on September 20, 2011 to Pekeema Brothers.	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	4.5
110	29	1809+00			Existing Prune and Walnut Orchard on right bank overflow area of the Feather River	No Rehabilitation Required		Trees	
111	29	1799+44	2,251,083.54	6,666,333.91	8"x .25" thick wall with exterior taped wrapped to a minimum thickness of 30 mil. The irrigation pipeline through levee	No Rehabilitation Required	The pipeline is meets Title 23 and is newer than 1995. No work required.	IR(P)	2.1

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
112	29	1792+96	2,250,482.00	6,666,094.79	24 inch CM drainage pipe through levee. Automatic drainage gate on waterside and concrete distribution box at waterside toe. Land side end of the pipe is not located. The CVFPB sent an encroachment violation notice on September 19, 2011 to Robert and Sandra Waller.	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR (G)	10.2
113	29	1790+00			Leveling and planting walnut and peach orchard on right overflow area of Feather River	No Rehabilitation Required		Trees	
114	29	1785+55			24 Inch CM drain pipe through levee. Concrete Headwall at land side. Automatic Drainage Gate on waterside with splash pad.	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SD(G)	
115	29	1785+24	2,249,771.67	6,665,793.11	24 Inch CM drain pipe through levee. Concrete Headwall at land side. Automatic Drainage Gate on waterside with splash pad.	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	5.7
116	29	1777+00	2,249,094.57	6,665,330.01	24 Inch CM drain pipe through levee. Concrete Headwall at land side. Automatic Drainage Gate on Waterside. The CVFPB sent an encroachment violation notice on September 19, 2011 to Robert and Sandra Waller.	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	4.5
117	29	1770+00			Existing walnut trees, located on the right bank of the Feather River.	No Rehabilitation Required		Trees	
	28/29	1769+31			Reach 28/29 Transition	Cutoff wall			
118	28	1767+67	2,248,176.53	6,665,251.10	Cox Spillway. North 60 Inch drain pipes through Levee. Slide Gates in 78 inch CM pipe wells on the waterside slope. Concrete bulkhead on both ends. Reinforced concrete spillway at the waterside end.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR (G)	8.4
119	28	1767+57	2,248,167.22	6,665,252.49	Cox Spillway. South 60 Inch drain pipes through Levee. Slide Gates in 78 inch CM pipe wells on the waterside slope. Concrete bulkhead on both ends. Reinforced concrete spillway at the waterside end.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR (G)	8.4
120	28	1767+30	2,248,140.77	6,665,254.84	To construct an 12kv aerial power line crossing of the right bank levee of the Feather River. The power line will extend from an existing pole located landward of the project levee to a new 50 foot pole located at least 20 feet water ward of the water ward toe of the levee/ The shall be 34 feet of clearance between the levee crown and the power line. The length of the span shall be 201 feet. The power line will extend from the 50 foot poles to a 30 foot pole to be located 135 downstream. This power line shall serve a pump covered by permit 11987 b Cox Brothers.	Cutoff wall		EL	OH
121	28	1766+00			To construct, operate, and maintain a 12kv aerial power line extension across the right bank levee, channel, and left bank overflow of the Feather River. A 55 foot pole will be installed 31 feet water ward of the water ward shoulder of levee. The overhead conductors will extend from an existing pole, located 138 feet landward of the landward toe of levee, the proposed 55 pole. The span between the two poles will be 212 feet. A minimum clearance of 35 feet will be provided between the overhead conductors and the top of the levee. The proposed extension will extend across the river and floodway for an additional 3,165.5 feet and will consist of an additional 10 poles.	Cutoff wall with Sutter Butte canal relocation		EL	OH
122	28	1765+33	2,247,975.94	6,665,181.76	12-inch CM pipe through the Levee. Slide Gate on the landside end and concrete distribution box on waterside.	Cutoff wall with Sutter Butte canal relocation	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(G)	4.5

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
123	28	1765+15	2,247,960.44	6,665,189.22	To install an irrigation pump on the right bank of the Feather River with a 12 inch steel pipe across the berm, levee, and the Sutter Butte Canal to existing orchards on the right bank downstream from Evans-Reimer Road. Concrete headwall at the waterside toe	Cutoff wall with Sutter Butte canal relocation	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(P)	0.7
124	28	1756+27	2,247,101.40	6,665,410.42	12-inch CM pipe through the Levee. Slide Gate on the landside end and concrete distribution box on waterside. The CVFPB sent an encroachment violation notice on August 16, 2011 to Mr. and Ms. Ratana.	Cutoff wall with Sutter Butte canal relocation	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR (G)	7.1
125	28	1753+50			To plant approximately 1.13 hectares of kiwi plants and install an irrigation system supplied by an existing water well.	Cutoff wall with levee relocation		Trees	
126	28	1753+50			To install an electrical pole line service extension to a new agricultural pump on the right bank overflow area of the Feather River.	Cutoff wall with levee relocation		EL	OH
127	28	1745+00			To retain a newly constructed barn on the right bank overflow area of the Feather River, approximately 150 feet water ward of the right bank levee of the Feather River	Cutoff wall with levee relocation		EL	OH
128	28	1741+32	2,245,620.98	6,665,550.58	Butte County Drainage District No. 1. A 16-Inch pipe through Levee. Emergency Repair Work on Pipe 3/5/02. Pipe not physically located	Cutoff wall with levee relocation	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	9.0
129	28	1728+33	2,244,365.98	6,665,826.21	To install a 12kv pole line westerly across the right bank levee of the Feather River and the Sutter Butte Canal, then northerly approximately 180 meters for service to well pump.	Cutoff wall with levee relocation		EL	OH
130	28	1724+61	2,244,008.46	6,665,796.35	12 kv overhead electrical power line and telephone line crossing	Cutoff wall with levee relocation	**Relocate outside of of the proposed right-of-way.**	EL	OH
131	28				Over steepened, ongoing erosion and caving in the irrigation canal.	Cutoff wall with levee relocation		struc	
132	28	1700+00 to 1728+00			1800 feet of 4.5 foot tall barbed wire fence located at waterside toe of levee. The application for the fencing was denied on October 2, 2000. No indication of appeal.	Cutoff wall with levee relocation		struc	
	27/28	1721+60			Reach 27/28 Transition	Cutoff wall with levee relocation			
133	27	1721+20	2,243,713.99	6,665,636.50	End 18" wide, 12-25 feet deep cutoff wall on crown with monitoring system 2000 lineal feet.	Cutoff wall with levee relocation		struc	
134	27	1707+34	2,242,329.23	6,665,666.71	Begin 18" wide, 12-25 feet deep cutoff wall on crown with monitoring system 2000 lineal feet.			struc	
	26/27	1707+11			Reach 26/27 Transition	Cutoff wall with levee relocation			
135	26	1699+62	2,241,637.34	6,665,378.46	Propane storage tanks at waterside toe of levee	Cutoff wall with levee relocation		struc	
136	26	1697+96	2,241,496.45	6,665,289.21	To retain a telephone line aerial crossing of the right bank levee of the Feather River. The aerial telephone line extends from a pole located landward of the Sutter Butte Main Canal to a pole located near water ward toe of the levee.	Cutoff wall with levee relocation	**Relocate outside of of the proposed right-of-way.**	TL	OH
137	26	1695+85			To construct a caretaker/ranch office and remove an existing structure on the right bank designated floodway of the Feather River.	Cutoff wall with levee relocation		Struc	
138	26	1691+00			A farm buildings (a walnut processing plant and shop) on the water ward toe of the right bank levee on the Feather River, 200 feet north of Chandon Avenue. The buildings are a 30 x 80 foot walnut dehydrator and a 40 x 40 shed.	Cutoff wall with levee relocation		Struc	
139	26	1690+00			To level and plant 160 acres of land between right bank levee and Feather River, off end of Chandon Avenue and opposite mouth of Honcut Creek	Cutoff wall with levee relocation		Trees	
140	26	1675+98	2,239,584.22	6,664,224.05	12 kv power line crossing of levee	Cutoff wall with levee relocation		EL	OH

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
	26	1675+50			Maintenance Area 16/ Maintenance Area 7 Transition	Cutoff wall with levee relocation			
141	26	1675+27	2,239,518.21	6,664,204.12	Butte County Drainage District No. 1. 60" x 72" RCP culvert through levee. Slide gate in concrete well on waterside slope.	Cutoff wall with levee relocation	The pipeline appears to meet title 23 requirements but will need to be removed and replaced because of the cutoff wall. **Replace in accordance with USACE standard**	SD(G)	17.0
	25/26	1674+37			Reach 25/26 Transition	Cutoff wall with levee relocation			
142	25	1670+00			To plant kiwi plants in place of fruit and nut trees on the right bank overflow of the Feather River south of Chandon Avenue near Live Oak.	No Rehabilitation Required		Trees	
143	25	1667+00			To clear the overflow area of brush and construct a foot bridge over an old channel that meanders across the overflow area. To install a septic tank and leach lines, electric service, drill a well and park a mobile home in the overflow area.	No Rehabilitation Required		Struc	
144	25	1665+32	2,238,525.15	6,664,192.56	To construct a 12 kv aerial power line extension across the levee and into the floodway of the Feather River. An existing pole on the landside of the levee will be replaced with a new 55 foot pole to be located 13 feet from the landward toe of the levee. The overhead conductors will extend across the levee to a 55 foot pole located in the floodway 140 feet from the waterside toe of the levee. The span between the 2 poles will be 233 feet. A minimum clearance of 31 shall be provided.	No Rehabilitation Required		EL	OH
145	25	1653+15	2,237,309.20	6,664,181.79	12 Kv overhead power line crossing and along levee	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	EL	OH
146	25	1650+00			To retain a walnut orchard on the right bank overflow area of the Feather River. The orchard is located a narrow strip of ground between the project levee and Drainage District No. 1's drain ditch.	No Rehabilitation Required		Trees	
147	25	1639+00	2,235,906.77	6,664,006.17	RD 777 Lateral 11. There are 2-24 inch steel pipes through levee. Automatic drainage gates on waterside end of pipe. The CFVPB sent an encroachment violation notice on September 20, 2011 to MMD Ranches.	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	16.2
148	25				Construction of Waterside Approach Ramp 500 feet north of Campbell Road and Meader Road	No Rehabilitation Required		struc	
149	25	1638+72	2,235,879.28	6,664,006.22	12 Kv overhead power line crossing and along levee	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	EL	OH
150	25	1635+00			To plant a prune orchard on the right bank overflow area of the Feather River at the end of Riviera Road	No Rehabilitation Required		trees	
	24/25	1623+86			Reach 24/25 Transition	Cutoff wall with levee relocation			
151	24	1611+30			12 Kv overhead power line crossing and along levee	Cutoff wall with levee relocation	**Relocate outside of of the proposed right-of-way.**	EL	OH
152	24	1610+92	2,233,196.84	6,664,513.54	RD 777 Lateral 12. An 18 inch CM pipe through levee. Automatic drainage gate on waterside end of pipe. The CVFPB sent an encroachment violation notice on July 26, 2011 to Theodore Bill. The violation was regarding the heavy vegetation on the waterside outfall pipe.	Cutoff wall with levee relocation	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	17.3
	23/24	1609+37			Reach 23/24 Transition				
153	23	1585+05			Abandoned 12 inch CM pipe through levee. Automatic drainage gate on waterside end of pipe	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(P)	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
154	23	1557+00			To add approximately 575 feet of 12 kv line to an existing power line on Cooley Road and within the overflow area of the Feather River	Cutoff wall		EL	OH
155	23	1556+58	2,228,785.42	6,665,751.32	To extend a 12 kv pole line from the intersection of Cooley Road and the right bank levee of the Feather across the levee and continue for 1500 feet easterly along Cooley Road. The pole line will serve a 25 HP river pump	Cutoff wall		EL	OH
156	23	1556+86			8 inch CM pipe through levee. Automatic drainage gate on waterside end of pipe.(No gate found)	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(P)	8.0
157	23	1555+00			To install pumping plants at two locations on the right bank of the Feather River	Cutoff wall		IR(P)	
158	23	1549+63	2,228,117.97	6,665,558.67	12 inch CM pipe through levee. Automatic drainage gate on waterside end of pipe. Pipe partially plugged. The CVFPB sent an encroachment violation notice on August 16, 2011 to Hatamiya Trust.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	12.5
159	23	1548+00			To level and plant walnuts and either peaches or prunes on the right bank overflow area of the Feather River upstream from Live Oak Park.	Cutoff wall		Trees	
160	23	1539+00			To install 25 HP pumping plants at two locations on the right bank of the Feather River	Cutoff wall		IR(P)	
161	23	1536+12	2,226,796.70	6,665,666.06	RD 777 Lateral 7. There is a 36 inch CM pipe through levee. Automatic drainage gate on waterside end of pipe. The CVFPB sent an encroachment violation notice on August 16, 2011 to Hatamiya Trust.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(G)	13.7
162	23	1535+95	2,226,780.47	6,665,668.20	To extend a 12 kv pole line 410 feet northerly to supply a 25 HP pump located in the river. The pump is pump referenced in permit 7380.	Cutoff wall		EL	OH
163	23				Excavation into toe of levee from up to 3 feet high on landside toe. The CVFPB sent an encroachment violation notice on August 16, 2011 to Hatamiya Trust.	Cutoff wall		Struc	
164	23	1535+64	2,226,750.14	6,665,678.35	To widen access road to Live Oak Recreation Area at the east end of Pennington Road on the right bank levee and berm of the Feather River	Cutoff wall		Struc	
165	23	1535+00			To Install 2500 lf of 2 inch diameter Sch 40 PVC water pipe and 600 lf of 1 inch Sch 40 PVC pipe within the west bank overflow. (Permit number has been changed to 7440-D)	Cutoff wall		W(P)	
166	23	1534+00			To construct a water supply system, a sanitary disposal system and restrooms for the Live Oak Recreational Area	Cutoff wall		Struc	
167	23	1533+40			Potential Pipe Crossing. 6" Steel through levee	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(P)	
168	23	1532+45	2,225,437.02	6,665,722.95	Water Well adjacent to Levee about 100 feet from toe	Cutoff wall		IR(P)	
169	23	1530+00			A trailer site, a porch, a metal storage building, fence across the waterside berm and waterside slope of the levee, on the right bank of the overflow area of the Feather River.	Cutoff wall		Struc	
170	23	1524+35			Potential Pipe Crossing. 6" Steel through levee	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(P)	
	22/23	1503+83			Reach 22/23 Transition	Cutoff wall			
171	22	1530+00			To authorize existing pear orchard and plant 10 additional acres on the right bank overflow of the Feather River downstream of Archer Road	Cutoff wall		Trees	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
172	22	1520+25			To extend approximately 1,950 feet of 12kv electric service line in the right bank overflow area of the Feather River downstream from Archer Avenue crossing	Cutoff wall		EL	OH
173	22	1493+88	2,222,717.57	6,664,731.41	Location of gate with no access	Cutoff wall		Fence	
174	22	1492+00			To construct an aerial telephone crossing of the right bank levee of the Feather River	Cutoff wall		TL	OH
175	22	1482+00			A 4 x 17 foot wooden walkway on the landside shoulder; two tool sheds, four walnut trees, a barbed wire and wooden fence within 10 feet landward of the landside toe, and an electrical gate across the crown of the right bank levee of the Feather River.	Cutoff wall		struc	
176	22	1479+98	2,221,343.18	6,664,540.45	Location of electric gate with no access	Cutoff wall		struc	
177	22	1470+15	2,220,360.26	6,664,561.50	A 4 x 17 foot wooden walkway on the landside shoulder and a 6 x 300 foot wooden lattice fence within 10 feet landward of the landside toe and parallel to the right bank of levee of Feather River.	Cutoff wall		struc	
178	22	1468+70			Four trees (oleander, pines, cherry, and birch) on the landside slope and a 5 foot high, 170 foot long wire fence within 7 feet of landward of the landside toe of the right bank levee of the Feather River.	Cutoff wall		struc	
179	22	1466+02	2,219,947.02	6,664,564.97	Transformer located 40'± from land side toe	Cutoff wall		EL	
180	22	1465+50			To construct access ramp across the right bank levee of the Feather River	Cutoff wall		struc	
181	~~22~~	~~1465+50~~			~~The existing 36 inch CMP installed in 1913 failed on March 1964. The permit was for repair of levee and removal of the pipe prior to November 1964.~~	Cutoff wall		~~IR(G)~~	
182	22	1461+00			To maintain existing your walnut orchards on the right bank of the Feather River, downstream from Bishop Avenue.	Cutoff wall with full levee degrade		Trees	
	22	1460+00			Levee District No. 9 Levees /Maintenance Area 16 Transition				
	21/22	1433+83			Reach 21/22 Transition				
183	21	1430+55	2,216,425.27	6,664,383.06	Sunset Pump Station owned an operated by Sutter Extension Main Pump Station. There is a 60 Inch steel pipe through the levee. Pump end has gate valves on structure. Automatic drainage gates on the landside end.	Cutoff wall with Sutter Butte canal relocation	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(P)	15.6
184	21	1430+47	2,216,417.64	6,664,382.64	Sunset Pump Station owned an operated by Sutter Extension Main Pump Station. There is a 60 Inch steel pipe through the levee. Pump end has gate valves on structure. Automatic drainage gates on the landside end.	Cutoff wall with Sutter Butte canal relocation	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(P)	15.6
185	21	1430+40	2,216,410.86	6,664,382.27	Sunset Pump Station owned an operated by Sutter Extension Main Pump Station. There is a 36 Inch steel pipe through the levee. Pump end has gate valves on structure. Automatic drainage gates on the landside end.	Cutoff wall with Sutter Butte canal relocation	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	IR(P)	15.6

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
186	21	1430+40			To construct and operate a vertical-perforated plate fish screen with a power operated brush on the right bank of Feather River. Located at Sunset Pump Plant.	Cutoff wall with Sutter Butte canal relocation		IR	
187	21	1430+00			36" CM pipe crossing through levee. The O&M manual indicates this pipeline is located 50 feet south of Sunset Pump Station but it appears this pipeline is the same pipeline addressed in Permit 4556 and 4719 located at Station 1465+50. The pipeline at Station 1465+50 was a 36 inch CMP installed in 1913 and removed in 1964. It should have shown on the O&M manual.	Cutoff wall with Sutter Butte canal relocation	There is no documenation of proper abandonment of the pipeline. We believe this pipeline was actually located at 1465+50 and removed per permit 4719. The type and size appear to match the Reclamation Board Permit. **Replace in accordance with USACE Standard.**	IR (G)	
188	21	1429+98	2,216,368.25	6,664,376.98	12 KV OH Power	Cutoff wall with Sutter Butte canal relocation		EL	OH
189	21	1429+68	2,216,338.71	6,664,376.58	12 KV OH Power	Cutoff wall with Sutter Butte canal relocation		EL	OH
190	21	1429+50			Existing rubble coffer dam constructed with Reclamation Board Permit 3610. Repair coffer dam.	Cutoff wall with Sutter Butte canal relocation		IR	
191	21	1428+50			Sutter Butte Main Canal Begin (Station 1428+50 to 1433+83) -Main Irrigation Canal approx 420 cfs	Cutoff Wall	**Recommended Relocation between station 1429+00 to 1433+83**	IR	
192	21				To construct a 12 KV pole line extension adjacent to the levee and across the floodway of the Feather River. The pole line will be located 30 feet from the waterside toe of the levee and will parallel the levee for a distance of 792 feet, thence across the floodway for a distance of 834 feet. The pole line extension will consists of three 264 foot spans and three 278 foot spans.	Cutoff Wall		EL	OH
193	21	1399+27	2,213,450.77	6,664,966.80	To install a 12 kv pole line across and along the right bank levee of the Feather River.	Cutoff Wall		EL	OH
194	21				To construct approximately 5,000 feet of lateral drain seepage relief trenches with perforated pipe and drain rock at the landward toe of the right bank levee for the Feather River. The proposed trench will be located at the landward levee toe at approximately 2 feet in width and 4 feet deep. LM 3.00 to 3.83 and LM 4.36 to 4.91. End Seepage Interceptor Trench	Cutoff Wall	No work proposed and the seepage drain can remain.	struc	
195	21				Plant 9 acres of Kiwi plants on waterside of levee between Bridgeford and Hermanson Avenues	Cutoff Wall		Trees	
196	21				Plant 14 acres of Kiwi plants on waterside of levee upstream of Hermanson Avenue	Cutoff Wall		Trees	
197	21				To construct a well and septic tanks for 2 mobile homes and to extend electrical service to well on right bank overflow area of Feather River	Cutoff Wall		Struc	
198	21				To plant 8 acres of kiwi plants, a submersible pump, and underground sprinkler system on the right bank overflow area of the Feather River	Cutoff Wall		Trees	
199	~~21~~				~~To pump storm water from landward drainage ditch over the right bank levee of the Feather River from one separate location for approximately size at the end of Hermansen Road.~~ **~~Pipe has been removed~~**	~~Cutoff Wall~~		~~SD(P)~~	
200	21	1391+96	2,212,767.43	6,665,226.86	To extend a 12 kv pole line out into the right bank levee and overflow area of the Feather River	Cutoff Wall		EL	OH
201	21	1375+35	2,211,296.56	6,665,998.34	Sutter Extension Sunset Lateral Begin (Station 1375+35 to 1428+50) Open irrigation ditch 15 feet from landside toe	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	Struc	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
202	21	1374+94	2,211,260.36	6,666,016.66	To construct approximately 5,000 feet of lateral drain seepage relief trenches with perforated pipe and drain rock at the landward toe of the right bank levee for the Feather River. The proposed trench will be located at the landward levee toe at approximately 2 feet in width and 4 feet deep. LM 3.00 to 3.83 and LM 4.36 to 4.91. Begin Seepage Interceptor Trench	Cutoff Wall		Struc	
203	21	1375+00			To level and plant 13 acres Peach Orchard on the right bank overflow area of the Feather River	Cutoff Wall		Trees	
	20/21	1374+33			Reach 20/21 Transition				
204	20	1350+00			To plant peach trees and to establish two wells and install pumping plants in right bank overflow of the Feather River	Cutoff Wall		struc	
205	20	1350+00			To extend 12 kv pole line parallel to the water ward toe of levee for a distance of approximately 1,500 feet north from Koch Lane, on the right bank overflow area of the Feather River/	Cutoff Wall		EL	OH
206	20				Excavation into toe of levee from 1 to 3 feet high and ground is tilled adajcent to the landside toe. The CVFPB sent an encroachment violation notice on August 17, 2011 to Julie M. Filter-Correll.	Cutoff Wall		Struc	
207	20	1347+37	2,208,612.74	6,666,676.45	To install a 60 foot pole 86 feet from the landward toe of the levee, a 60 foot pole 10 feet from the water ward toe of the levee and 6 additional poles on the right bank overflow of the Feather River. The 12kv electrical service will be extend across the levee to serve a pump installed under Permit 6380. The span across the levee will be 234 feet. The clearance between the overhead wires and the top of the levee will be 31 feet.	Cutoff Wall		EL	OH
208	20	1347+00	2,208,582.82	6,666,680.19	Missile Communication Cable System. Installation of an underground cable at a minimum depth of 3 feet, a corrugated metal cutoff wall is located on each cable, from Beale Air Force Base to the vicinity of Chico Airport, crossing several channels in Butte, Placer, Sutter, and Yuba Counties. In 1968 the USACE requested approval to abandon the cable in-place and cut	Cutoff Wall	The cable does not meet title 23 requirements. According to email from US Government to WR, the cable is no longer in use and can be disposed. **Replace in accordance with USACE standard**	TL	4.0
209	20	1345+00			To plant prune orchard on the right bank overflow area of the Feather River, downstream from Koch Road	Cutoff Wall		Trees	
210	20	1345+00			To retain walnut orchard on the right bank overflow area of the Feather River, downstream from Koch Road	Cutoff Wall		Trees	
211	~~20~~	~~1328+10~~			~~To install 3 temporary discharge pipelines across the right bank levee of the Feather River. The proposed pipeline will be in installed in three separate locations at LM 3.53, 3.72, and 3.78. The pipelines will be exposed on the levee slopes and will have a pad constructed over them across the levee crown.~~ **~~Pipe has been removed.~~**	Cutoff Wall		~~SD(P)~~	
212	20	1328+00			To construct a 12 kv aerial power line on the right bank overflow area of the Feather River	Cutoff Wall		EL	OH
213	20	1327+00	2,206,597.56	6,666,928.33	12KV overhead power line crossing	Cutoff Wall		EL	OH
~~214~~	~~20~~	~~1317+15~~			~~To install 3 temporary discharge pipelines across the right bank levee of the Feather River. The proposed pipeline will be in installed in three separate locations at LM 3.53, 3.72, and 3.78. The pipelines will be exposed on the levee slopes and will have a pad constructed over them across the levee crown.~~ **~~Pipe has been removed.~~**	~~Cutoff Wall~~		~~SD(P)~~	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
215	20	1315+03	2,205,398.45	6,666,943.63	To construct approximately 5,000 feet of lateral drain seepage relief trenches with perforated pipe and drain rock at the landward toe of the right bank levee for the Feather River. The proposed trench will be located at the landward levee toe at approximately 2 feet in width and 4 feet deep. LM 3.00 to 3.83 and LM 4.36 to 4.91. End Seepage Interceptor Trench	Cutoff Wall		Struc	
216	20	1314+80	2,205,375.80	6,666,944.25	Micheli Storm Drainage Pump Station. To install a pump with 20 Inch steel discharge pipe through the right bank of the Feather River for the removal of stormwater.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	SD(P)	2.0
217	20	1312+08			To plant an orchard and grade the land on the right bank overflow area of the Feather River. The project is located north of Yuba City approximately 5.5miles.	Cutoff Wall		Trees	
~~218~~	~~20~~	~~1305+30~~			~~To pump storm water from landward drainage ditch over the right bank levee of the Feather River from one separate location for approximately size at the end of Hermansen Road.~~ **~~Pipe has been removed~~**	~~Cutoff Wall~~		~~SD(P)~~	
	19/20	1297+83			Reach 19/20 Transition				
219	19	1295+00			To plant an orchard and grade the land on the right bank overflow area of the Feather River. The project is located north of Yuba City approximately 1.3 miles upstream (north) of the intersection of Eager Road and Live Oak Boulevard.	Cutoff Wall		Trees	
220	19	1293+66	2,203,266.22	6,666,867.99	End Concrete Lined Ditch on landside toe of levee	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	struc	
221	19	1293+66	2,203,266.22	6,666,867.99	12 KV Overhead Power line crossing of levee. One pole 6 foot from levee toe.	Cutoff Wall		EL	OH
222	19				To construct approximately 5,000 feet of lateral drain seepage relief trenches with perforated pipe and drain rock at the landward toe of the right bank levee for the Feather River. The proposed trench will be located at the landward levee toe at approximately 2 feet in width and 4 feet deep. LM 3.00 to 3.83 and LM 4.36 to 4.91. Begin Seepage Interceptor Trench	Cutoff Wall		struc	
223	19	1284+91	2,202,406.27	6,666,705.08	Begin Concrete Lined Ditch on landside toe of levee	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	struc	
224	19	1266+71	2,200,600.09	6,666,626.50	12KV overhead power line crossing	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
225	19	1265+59	2,200,487.69	6,666,648.86	Sullivan Pump Station. 18 inch steel pipe through the levee. Pump and Gate valve in pump house on the channel bank. Concrete well on the bank. Siphon breaker in CMP riser on landside slope. (Sullivan Pump Station)	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and anti-siphon device on waterside hinge of levee. The pipe line is pressurized and need to be installed above the design water surface. The current installation is at-grade. **Replace in accordance with Title 23**	IR(P)	18.3
226	19	1229+41	2,197,325.05	6,668,184.53	Kewal Singh IR PS. A 16 inch steel pipe through levee. Pump in pump house on channel bank. Gate valve on the waterside end. Concrete standpipe.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and anti-siphon device on waterside hinge of levee. The pipeline is pressurized and will need to be installed about the design water surface. **Replace in accordance with USACE standard**	IR(P)	3.0 or deeper through levee?
227	19	1226+06	2,197,092.42	6,668,425.95	12 KV power pole located in landside slope	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
	18/19	1213+85			Reach 18/19 Transition				

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
228	18				Excavation into the toe of levee on waterside 0.5 to 3 feet high with near vertical slope. CFPB sent an encroachment violation notice on July 27, 2011 to Kewall Singh.	Cutoff Wall		struc	
229	18	1201+00			Wilbur Ranch Irrigation Water Well located within 50 feet of levee toe. Underconstruction as of March 6, 2012.	Cutoff Wall		well	
230	18	1200+69	2,194,694.58	6,669,169.33	Wilbur Ranch Irrigation Water Well located within 10 feet of levee toe. There is also a service pole and electrical panel.	Cutoff Wall	The water well does not meet Title 23 since too cloase to levee. The water well is located within the proposed right-of-way for levee project. **Relocate outside of of the proposed right-of-way.**	well	
~~231~~	~~18~~	~~1200+69~~	~~2,194,694.58~~	~~6,669,169.33~~	~~Abandoned 10 inch steel pipe through levee. Waterside end open. Steel Plate welded on landward end. Pump and Standpipe at the landside end.~~	~~Cutoff Wall~~	~~Not sure if the abandonment meets title 23 requirements. Pipe may need to be properly abandoned or completely removed.~~	~~IR(P)~~	~~2.8~~
232	18	1195+20			12 KV power line in overflow and levee crossing north of Rednall Road	Cutoff Wall		EL	OH
~~233~~	~~18~~	~~1182+75~~			~~20 Inch steel pipeline through levee **(not installed)** - Plans prepared by MHM Job No. 78-158~~	~~Cutoff Wall~~	~~Pipe eas never installed. No work.~~	~~IR(A)~~	~~3.0~~
234	18	1181+50			Abandoned 8 inch steel pipe through levee. Pipe plugged on the waterside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(A)	4.0
235	18	1180+98	2,192,727.96	6,669,163.92	3 inch steel pipe through levee crown	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(P)	1.0
236	18	1180+50			One 12 inch steel pipe through levee. Pipe exposed on landside slope	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(P)	1.0
237	18	1180+00			To construct a 15 inch diameter corrugated metal drain pipeline across the overflow area and through the right bank of the Feather River. The proposed pipeline will be 625 feet in length and have 15 feet of cover.	Cutoff Wall		SD(G)	
~~238~~	~~18~~	~~1182+75~~			~~To install an irrigation pump and a buried pipeline landward over the right bank levee of the Feather River, upstream Rednall Road. **Not install per Reclamation Board**~~	~~Cutoff Wall~~		~~IR(P)~~	
239	18	1174+05	2,192,034.01	6,669,096.85	Water Well and Pump 20 feet from Landside toe	Cutoff Wall	The water well is located within the proposed right-of-way for levee project. **Relocate outside of of the proposed right-of-way.**	well	
240	18	1170+04	2,191,638.99	6,669,057.61	12KV overhead power line crossing	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
241	18	1152+55	2,189,899.09	6,668,879.71	Twin 110 KV Tower line across Feather River	Cutoff Wall		EL	OH
242	18	1138+22	2,188,574.27	6,668,732.99	12 KV and 40/60 KV power pole located in landside slope	Cutoff wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
243	18	1135+31	2,188,188.41	6,668,676.43	16 inch gas line through the levee. Marker post on the waterside shoulder	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	GL	3.5
244	18	1133+00			To construct 1,180 feet of 12 kv line in the right bank overflow area of the Feather River	Cutoff wall		EL	OH
	18	1132+61			Levee District No. 1 Levees /Levee District No. 9 Transition				

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
245	18	1132+09	2,187,967.19	6,668,647.98	8-5/8" steel pipeline within railroad right-of-way parallel to tracks	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	GL	
246	18	1131+82	2,187,840.25	6,668,647.20	Fiber optic cable	Cutoff wall	The cable does not meet title 23 requirements. **Replace in accordance with USACE standard**	TL	
	17/18	1130+86			Reach 17/18 Transition				
247	17	1130+47	2,187,705.38	6,668,643.93	Union Pacific Railroad Crossing. There is no stop log structure.	Jet Grouting		RR	6.0
248	17	1128+00			To construct a ramp on the waterside slope of the right bank levee on the Feather River adjacent to the SPRR.	Cutoff wall		Struc	
249	17	1127+48	2,187,405.84	6,668,629.29	Village Green Trailer Park - To install a 10 inch outfall pipe through the right bank levee of the Feather River to provide storm drainage for a mobile home park.	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	
250	17	1125+00			An existing irrigation well in the right bank overflow area of the Feather River.	Cutoff wall with landside toe fill		Well	
251	17	1111+46	2,185,808.02	6,668,723.59	West Onstott Frontage Road Pump Station and Clark Avenue Pump Station Drainage Area. 16 Inch welded steel 7 GA asphalt coated storm drain discharge pipe over levee connected to 24 inch pipe in overflow area, outfall ditch, and pipes in floodway (Source: City of Yuba City Pump Station No. 4 and City of Yuba City Pump Station No. 2)	Cutoff wall with landside toe fill	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	1.1
252	17	1107+82	2,185,444.63	6,668,754.75	12 KV crossing & power pole located in landside slope	Cutoff wall with landside toe fill	**Relocate outside of of the proposed right-of-way.**	EL	OH
253	17				To install an intertie to an existing waste water line and abandon approximately 40 feet of 24 inch diameter pipe on the right bank of the Feather River.	Cutoff wall		RW(P)	4.0
254	17	1096+81	2,184,421.28	6,669,119.50	Yuba City Water Treatment Plant 28" (29 25/32" OD) 7 GA welded steel waterline pipe crossing of levee. New permit included installation of automatic drainage gates on pipelines. (copy of record drawings)	Jet Grouting	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	RW(P)	5.0
255	17	1096+71	2,184,412.72	6,669,124.71	Yuba City Water Treatment Plant 24" 7 GA welded steel waterline pipe crossing of levee. New permit included installation of automatic drainage gates on pipelines. (copy of record drawings)	Jet Grouting	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	RW(P)	4.7
256	17	1096+62	2,184,404.80	6,669,129.53	Yuba City Water Treatment Plant 42"cement mortar lined and coated welded steel pipe waterline crossing of levee (copy of record drawings)	Jet Grouting	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	RW(P)	2.5
257	17	1096+50	to be installed	to be installed	Yuba City Water Treatment Plant 48"cement mortar lined and coated welded steel pipe waterline crossing of levee (to be installed and requested by the City of Yuba City)	Jet Grouting	This is a new pipelines that will meet Title 23 and USACE requirements except as noted in variance column. **Replace in accordance with USACE standard**	RW(P)	2.0
258	17	1096+74	2,184,416.62	6,669,124.90	To install a 12 kv aerial pole line extension across the right bank levee of the Feather River. The pole line shall serve the Yuba City Water treatment Plant intake pump station	Jet Grouting		EL	OH
259	17	1093+12			Telephone Call box on landside hinge point	Cutoff wall	**Relocate outside of of the proposed right-of-way.**	TL	
260	17	1086+33			Construction of an 80 foot high Monopole for a Cell Tower. The work includes a 32' x 83' compound, PG&E 100 KVA transformer box, 600 AMP PG&E Electrical Meter Service.	Cutoff wall		Cell	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
	16/17	1080+00			Reach 16/17 Transition				
261	16	1079+91	2,183,133.99	6,670,212.82	8 inch Gas Line	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	GL	3.5
262	16	1073+41	2,182,671.85	6,670,670.15	16 inch Gas Line (PG&E Map shows the gas main as 12 inch)	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	GL	3.5
263	16				Excavation into the levee on the waterside approximately 0.5 to 2 feet, near vertical in some places. Minor rutting, ponding, and depressions in the levee toe road. CVFPB sent a encroachment violation notice on August 16, 2011 to City of Yuba City.	No Rehabilitation Required		struc	
264	16	1054+75	2,181,074.23	6,671,588.96	Telephone Call box on landside hinge point	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	TL	
265	16	1043+52	not verified		Abandon 36 inch pipe	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SS(G)	
266	16	1043+52	2,180,149.57	6,672,223.24	Abandoned 27 inch Centrifugal Spun Concrete Pipe. City of Yuba City Drawing 214-D per 1949 plans	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SS(G)	38.6
267	16	1043+45	2,180,137.11	6,672,230.51	To install a 36 Inch discharge pipe through right bank of Feather River.	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	5.0
268	16	1043+27	2,180,126.23	6,672,235.13	To install a 24 inch wrapped steel pipe through the right bank levee of the Feather River	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	2.0
269	16	1043+22	2,180,121.72	6,672,237.88	To construct a 24 inch steel pipe storm drainage discharge pipe crossing the west levee of the Feather River	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	4.0

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
270	16	1043+03	2,180,106.36	6,672,244.70	Gilsizer Slough Storm Drain Facilities. A 16 inch welded steel discharge pipe crossing of levee. (copy of record drawings)	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	1.3
271	16	1037+50	Not Verified		Abandoned 8 inch gas line through levee. Removed per Permit 1445A	No Rehabilitation Required	Not sure if the abandonment meets title 23 requirements. Pipe may need to be properly abandoned or completely removed.	GL	
272	16				To construct approximately 4,400 lineal feet of filter trench adjacent to the right bank levee of the Feather River. The proposed trench will be located at the landward levee toe, be 3 feet wide and 4 feet deep.	No Rehabilitation Required			
273	16	1028+11	2,178,636.47	6,672,461.02	Power pole in waterside slope	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	EL	
274	16	1029+10	2,179,608.80	6,672,356.03	To bury existing two submarine telephone cables into two parallel trenches 100 feet apart in the channel of the Feather River. Both cables were installed per Permit 1334 in September 15, 1948. The permit stated the cable will be buried to a depth of five feet in the levees.	No Rehabilitation Required	The conduit may not meet title 23 requirements. **Replace in accordance with USACE standard**	TL	5.0
275	16	1028+10	2,179,506.59	6,672,370.16	To bury existing two submarine telephone cables into two parallel trenches 100 feet apart in the channel of the Feather River. Both cables were installed per Permit 1334 in September 15, 1948. The permit stated the cable will be buried to a depth of five feet in the levees.	No Rehabilitation Required	The conduit may not meet title 23 requirements. **Replace in accordance with USACE standard**	TL	2.0
276	16	1026+71	21,784,783.54	6,672,514.29	10" overside Drain line on the water side levee slope for bridge area drainage	Seepage berm	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Replace in accordance with USACE standard**	TL	
277	~~16~~	~~1026+70~~			~~To place a 10 Inch diameter conduit containing fiber optic cables across and under (bored) the channel and through the right bank of the Feather River. The permit was withdrawn on 9-6-00 according to the CVFPB file.~~	Seepage berm		TL	
278	16	1026+58	2,178,488.35	6,672,429.49	40 foot long retaining wall landside of levee just upstream of the Feather River Bridge	Seepage berm		Road	
279	16	1026+22	2,178,451.96	6,672,425.20	Feather River Bridge (SR 20) upstream side	Seepage berm		Bridge	
280	16	1025+32	2,178,375.92	6,672,443.76	Feather River Bridge (SR 20) downstream side	Seepage berm		Bridge	
281	16	1025+32	2,178,375.92	6,672,443.76	Seismic Retro of Feather River Bridge and bike paths on both sides of bridge	Seepage berm		Bridge	
282	16	1024+95	2,178,319.03	6,672,456.34	12 kv power line across levee	Seepage berm	**Relocate outside of of the proposed right-of-way.**	EL	OH
283	16	1024+70			Backfill Community Swimming Pool located near the base of the Feather River Bridge (10th Street Bridge)	Seepage berm		struc	
284	16	1024+48	2,178,296.55	6,672,470.53	40 foot long retaining wall landside of levee just downstream of the Feather River Bridge	Seepage berm		Road	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
285	16	1021+95	2,178,044.07	6,672,487.29	12 kv power line across levee	No Rehabilitation Required		EL	OH
286	16	1021+00			Telephone line on river slope of levee 260 feet downstream of Feather River Bridge (10th Street Bridge)	No Rehabilitation Required		TL	
287	16	1020+85			Abandon 4 inch pipe	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SD(G)	1.3
288	16	1020+30	2,177,879.35	6,672,496.38	Telephone Call box on waterside hinge point	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	TL	
289	16	1019+82	2,177,832.15	6,672,504.71	Power pole in waterside slope	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	EL	OH
290	16	1013+00			To place approximately 4,000 feet of blanket drain and filter trench on the right bank of levee of the Feather River upstream and downstream of the SR 20 Bridge	No Rehabilitation Required		Struc	
291	16	1010+75	2,176,773.87	6,672,930.97	Install Guy within in landside slope of levee, 12 kV overhead electric	No Rehabilitation Required		EL	
292	16	1008+38	2,176,779.63	6,672,929.15	12 kv power line across levee	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	EL	OH
293	16	1007+50			To construct approximately 1,300 feet of 12 foot wide bicycle trail on the crown of the right bank levee of the Feather River. The Project is located in Yuba City between the 5th Street Bridge and the easterly extension of Teagarden Avenue.	Jet Grouting		Struc	
294	16	1007+50			4' by 3' deep erosion pocket. 4 foot vertical bank under Twin Cities Memorial Bridge	Jet Grouting		struc	
295	16	1007+50			To construct a bicycle trail for approximately 3.5 miles on the right bank levee other the Feather River from Shanghai Bend Road to Northgate Boulevard	Jet Grouting		Road	
296	16	1007+50			Bike Path below Twin Cities Memorial Bridge	Jet Grouting		Road	
297	16	1007+51	2,176,709.34	6,672,981.09	Twin Cities Memorial Bridge upstream side	Jet Grouting		Bridge	
298	16	1007+46	2,176,706.50	6,672,984.37	Light pole in water side levee slope	Jet Grouting	**Relocate outside of of the proposed right-of-way.**	EL	OH
299	16	1007+06	2,176,671.72	6,673,005.93	Twin Cities Memorial Bridge downstream side	Jet Grouting		Bridge	
300	16	1006+93	2,176,642.84	6,672,995.25	Power line and Anchor in Levee (actual location)	Jet Grouting		EL	
301	16	1006+60	2,176,647.27	6,673,046.63	Sacramento Northern Railroad	Jet Grouting		RR	
302	16	1006+07	2,176,610.55	6,673,084.90	Power Pole and anchor in slope of levee. 100 feet south of the SNRR bridge w/ service power overhead	Jet Grouting		EL	OH
303	16	1006+00			City of Yuba City. To replace the existing retaining wall with an 8 foot high, 76 foot long concrete retaining wall on the landside of the right (east) bank levee of Feather River.	Jet Grouting		struc	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
304	16	1005+80			Concrete steps and 4 inch diameter PVC pipe on the landward slope and a pump house within 10 feet of the landward toe.	No Rehabilitation Required		struc/IR (P)	
305	16	1003+72	2,176,461.52	6,673,266.98	Power Pole and anchor in slope of levee. 300 feet south of the SNRR bridge	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	EL	OH
306	16	1000+50			A 3-wire barded wire fence with a gate within 5 feet of the levee toe and two mature trees at the landward toe. The project is located on Keyser Street	No Rehabilitation Required		struc	
307	16	999+90			A 120 foot long building at the landward toe	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	struc	
308	16	995+50			Authorize a 3-wire barded wire fence and two mature trees at the landward toe. The project is located at 563??? Second Street	No Rehabilitation Required		struc	
~~309~~	~~16~~	~~995+50~~			~~To excavate 25 feet into landward side of the right bank of the Feather River and construct a concrete retaining wall to provide parking lot space. The project is located at 463 2nd Street behind the Sutter County Administration Building/~~	~~No Rehabilitation Required~~		~~struc~~	
~~310~~	~~16~~	~~993+56~~			~~To install approximately 1,010 feet of 8 foot high chain link fence on the waterside side of the right bank levee of the Feather River.~~	~~No Rehabilitation Required~~		~~struc~~	
311	16	993+25			A building near the landward toe of the levee.	No Rehabilitation Required		struc	
312	16	992+00			A shed, concrete wall, and chain-link fence with gate at landward toe. The permit also covers two steel posts on the shoulder and seventeen mature trees on the landward slope	No Rehabilitation Required		struc	
313	16	991+00			A shed at the landward toe	No Rehabilitation Required		struc	
314	16	992+00			A two-story garage and shop building at the landward toe and six mature trees on the landward slope	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	struc	
315	16	989+75			A building at the landward toe and 21 mature trees and sprinkler system on the landward slope.	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	struc	
316	16	988+05	2,175,065.02	6,673,942.87	3 inch steel pipe, does not appear to cross levee anymore	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(P)	
317	16	989+20			A garage and a shed at the landward toe	No Rehabilitation Required		struc	
318	16	988+50			Authorize a small building, a chain-link fence, four mature trees at the landward toe, and five clumps of oleanders on the landward slope.	No Rehabilitation Required		struc	
319	16	987+60			Authorize a small building and a chain link fence on an existing retaining wall at the landward toe, concrete stairs, a steel pipe frame, and two large mature trees on the landward slope. A hose bib on the landward shoulder of the right bank of levee.	No Rehabilitation Required	**Recommended Relocation**	struc	
320	16	986+75			A see-through fence on a 5 foot retaining wall, steps, and nine mature trees on the landward slope.	No Rehabilitation Required		struc	
321	16	986+00			Concrete steps with railing and pomegranate bush on landward slope. The permit also covers a concrete retaining wall at the landward toe.	No Rehabilitation Required		struc	
322	16	985+30			Chain Link fence with gate, three oleander trees, and steps within the landward slope.	No Rehabilitation Required		struc	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
323	16	984+50			Chain Link fence with gate, three oleander trees, and steps within the landward slope.	No Rehabilitation Required		struc	
324	16	983+20			A building, barbed wire fence, and ten trees at landward toe	No Rehabilitation Required		struc	
325	16	981+25			A 60 foot long see-through board fence and 75 foot long clothesline and landward toe. A shed 5 feet from landward toe and a mature oak tree on the landward slope	No Rehabilitation Required		struc	
326	16	980+15			A chain-link fence with gate within 10 feet of landward toe	No Rehabilitation Required		struc	
327	16	979+90			A see-through fence and storage shed within 10 feet of the landward toe. The project is located at 265 Second Street, Yuba City, CA	No Rehabilitation Required		struc	
328	16	979+40			A see-through fence and storage shed within 5 feet of the landward toe. The project is located at 261 Second Street, Yuba City, CA	No Rehabilitation Required		struc	
329	16	978+80			A Chain Link fence with gate within 5 feet of landward toe, a cedar tree at the landward toe, and stone steps on the landward slope. This project is located at 255 Second Street.	No Rehabilitation Required		struc	
330	16	976+10			A shed and three trees at the landward toe of the right bank levee of the Feather River. The project is located at 225 Second Street, Yuba City, CA 95591	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	struc	
331	16	975+40			A 6 foot high chain link fence and gate at the right bank levee of the Feather River	No Rehabilitation Required		struc	
332	16	974+25			A residence within 5 feet of the landward toe	No Rehabilitation Required		struc	
333	16	973+30			A residence at landward toe and oak on the landward slope	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	struc	
334	16	975+00			To construct a restroom facility with septic tank and leach lines at the Yuba City Boat Ramp on the right bank of the Feather River.	No Rehabilitation Required		struc	
335	16	972+29			2 Inch Domestic Water Line serving the Yuba City Boat Dock.	No Rehabilitation Required	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with Title 23**	W(P)	
336	16	972+00			To construct improvement for the boat launching ramp and related facilities on the right bank of the Feather River.	No Rehabilitation Required		struc	
337	16	972+00			To construct improvement for the Yuba City Boat Ramp consisting of a paved parking area, restroom facilities, floating boat dock and extension of concrete boat ramp on the right bank of the Feather River.	No Rehabilitation Required		struc	
338	16	972+00			To reconstruct an existing access road to the Yuba-Sutter Boat Ramp on the right bank of the Feather River	No Rehabilitation Required		struc	
339	16	972+00			To maintain and operate existing boat dock for public use for boating, fishing, and a campground with related facilities including a mobile home on the right bank of the Feather River.	No Rehabilitation Required		struc	
	15/16	968+50			Reach 15/16 Transition	No Rehabilitation Required			
340	15	968+00			To construct 120 lineal feet of sheet piles retaining wall, and nine 10 x 10 foot boat docks supported by seven 12 inc diameter steel piles to an existing 30 foot wide ramp (Yuba City Boat Ramp)	No Rehabilitation Required	Located within floodway. Does not affect levee project.	struc	
341	15	964+78			Telephone Call box on waterside hinge point	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	TL	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
	14/15	954+40			Reach 14/15 Transition	No Rehabilitation Required			
342	14	952+00			12 kv cable	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	EL	UG
	13/14	927+00			Reach 13/14 Transition	No Rehabilitation Required			
343	13	925+16			Telephone Call box on waterside hinge point	No Rehabilitation Required	**Relocate outside of of the proposed right-of-way.**	TL	
344	13	925+00			To construct access ramps	No Rehabilitation Required	Located within floodway. Does not affect levee project.	struc	
345	~~13~~	~~920+00~~			~~Consolidated Area Housing Authority of Sutter County. Strom Drainage Pipe Crossings. The size and location of the pipe is unknown. They have retention pond located at southwest corner of the airport. The Airport Business Park proposed crossing but application never filed.~~	~~Cutoff Wall~~	~~The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed.~~ **~~Replace in accordance with Title 23~~**	~~SD (P)~~	
346	13	913+19	2,168,046.21	6,673,496.81	Two 16 inch gas lines. (PG&E map shows the gas lines as 2-12 inch)	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	GL	3.0
347	13	894+23	2,166,221.70	6,673,147.49	To install a 12kv buried power cable through the right bank levee and across the right bank overflow of the Feather River, a total distance of 896 feet. Poles will be installed near the top of the banks of the low water channel and aerial cable will be placed between the two poles which will be connected to the underground cable.	Cutoff Wall	The cable appears to meet title 23 requirements but the cutoff wall will remove improvements. **Replace in accordance with USACE standard**	EL	UG
348	13	893+84	2,166,181.41	6,673,142.43	Garden Highway Industrial Park. To install a 12 inch steel storm drain pipeline through the right bank levee of the Feather River (Source: City of Yuba City Pump Station No. 1)	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	3.3
349	13	893+78	2,166,175.45	6,673,142.43	Burns Drive Storm Water Pump Station. 16 inch steel storm drain discharge pipe through levee. (Source: City of Yuba City Pump Station No. 1)	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	2.7
350	13	881+40	2,164,942.19	6,673,036.13	Levee District No. 1 Relief Well Pump Station 6" pipes located just southeast of the Waste Water Treatment Plant. The waterside outlet structure has cobbles and the flap gate is damaged or plugged. CVFPB sent a notice of encroachment violation on August 16, 2011 to Sutter County.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Recommended Removal**	RW(P)	5.1
351	13	881+43	2,164,944.70	6,673,036.17	Levee District No. 1 Relief Well Pump Station 14" pipes located just southeast of the Waste Water Treatment Plant. The waterside outlet structure has cobbles and the flap gate is damaged or plugged. CVFPB sent a notice of encroachment violation on August 16, 2011 to Sutter County.	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Recommended Removal**	RW(P)	5.1
352	13	856+23	2,162,702.52	6,674,085.34	South Yuba City Seepage Interceptor Pump Station 24 inch 7 GA Steel Pipe asphalt coated and wrapped with asphalt saturated felt discharge pipe (Source: City of Yuba City Pump Station No. ?)	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Recommended Removal**	SD(P)	5.2
353	13	856+08	2,162,689.81	6,674,093.30	South Yuba City Storm Drainage Pump Station 24 inch 7 GA Steel Pipe asphalt coated and wrapped with asphalt saturated felt discharge pipe (Source: City of Yuba City Pump Station No. 3)	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SD(P)	5.2

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
354	13				Seepage Interceptor Trench and additional relief wells. The improvements were adjacent to the River Oaks subdivision between the wastewater treatment plant and Shanghai Road. All work on landside of levee.	Cutoff wall		struc	
355	13	849+85			Telephone Call box on waterside hinge point	Cutoff wall	**Relocate outside of of the proposed right-of-way.**	TL	
356	13				Bike Path below Twin Cities Memorial Bridge	Cutoff wall		struc	
	12/13	845+00			Reach 12/13 Transition				
~~357~~	~~12~~				~~Shanghai Bend Road Setback levee project~~	No Rehabilitation Required		~~struc~~	
358	12	832+24	to be installed	to be installed	City of Yuba City Sewer 24 inch welded steel pipe mortar lined and coated pipe discharge pipe. This pipeline shall replace the existing 24 inch located at Station 828+55. The existing pipeline will be removed and disposed.	No Rehabilitation Required	This is a new pipelines that will meet Title 23 and USACE requirements except as noted in variance column.	SS(P)	2.0
359	12	832+17	to be installed	to be installed	City of Yuba City Sewer 2-24 inch welded steel pipe mortar lined and coated pipe discharge pipe. This is a new pipeline requested by the City of Yuba City.	No Rehabilitation Required	This is a new pipelines that will meet Title 23 and USACE requirements except as noted in variance column.	SS(P)	2.0
	11/12	830+00			Reach 11/12 Transition				
360	11	828+55	2,160,267.77	6,675,134.01	City of Yuba City Sewer 24 inch welded steel pipe mortar lined and coated pipe (wall thickness 0.188" min) Discharge Pipe to river diffuser	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed. **Replace in accordance with USACE standard**	SS(P)	2.3
~~361~~	~~11~~				~~To place an 18 inch storm drain pipeline through the levee on the right bank of the Feather River **(project was not completed - no pipeline installed)**~~	~~Cutoff Wall~~		~~SD(P)~~	
	10/11	774+00			Reach 10/11 Transition	Cutoff Wall			
362	10	771+30			Construct a gaging station approximately 150 feet downstream form the present gaging station, known as Feather River below Shanghai Bend. It is proposed to install an 8 foot high by 5 foot 4 inch square recorder house on the right bank berm approximately 155 feet from centerline of levee.	Cutoff Wall		struc	
363	10	750+40	2,152,869.21	6,673,338.66	115 kv steel tower transmission line crossing of levee	Cutoff Wall		EL	OH
364	10	750+10	2,152,823.05	6,673,332.24	12 kv power line crossing of levee	Cutoff Wall		EL	OH
	9/10	706+50			Reach 9/10 Transition	Cutoff Wall			
365	9	692+00			To construct 140 lineal feet of sheet piles retaining wall, and nine 10 x 20 foot boat docks supported by seven 12 inch diameter steel piles to an existing 30 foot wide ramp (Boyd Pump Boat Ramp)	Cutoff Wall	Located within floodway. Does not affect levee project.	struc	
366	9	692+00			To improve the existing Boyd Pump Boat Launching Facility by widening the existing ramp to 30 feet with 4 foot walkways on each side, paving existing access road, and expanding parking area by 25 spaces, and placing riprap on the right bank of the Feather River.	Cutoff Wall		Struc	
367	9	692+00			To construct boat launching ramp, well, pump, pressure system, and sanitary facilities on the right bank overflow of the Feather River	Cutoff Wall		Struc	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
368	9	689+09	2,146,949.33	6,672,031.04	Oswald Mutual Water Company (Boyd's Pump) 18 inch epoxy coated mortar lined steel pipe through existing 24 inch concrete pipe crossing of levee	Cutoff Wall	The pipeline does not meet title 23 requirements. The facility will need to go up and over the levee and will need a positive shut-off structure installed and anti-siphon device. **Replace in accordance with USACE standard**	IR(P)	27.6
369	9	689+00	2,146,953.52	6,672,029.11	To replace an existing pole line with a new pole line across the right bank levee of the Feather River. A new pole will be placed 10 feet landward of the landward toe of the levee and another pole will be placed 24 feet water ward of the water ward toe of the levee.	Cutoff Wall		EL	OH
370	9	689+00	2,146,953.52	6,672,029.11	To place a service line on a PG&E pole crossing the right bank levee of the Feather River	Cutoff Wall		TL	OH
371	9	688+90			Irrigation Production Well (located 25 foot west of landside levee toe)	Cutoff Wall		well	
372	9	669+20			Sierra Gold Nursery. Service Pole, Electrical Panel, Meter, and Irrigation Production Well 30 feet from landside levee toe.	Cutoff Wall		well	
373	9	664+07	2,144,450.88	6,672,127.42	Sierra Gold Nursery. An 8 inch steel pipe through levee. This pipe was pressure checked and in 1984 as part of permit 13980 to connect to existing pipe.	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off structure and anti-siphon device installed. **Replace in accordance with USACE standard**	SD(P)	3.6
374	9	664+20			To reconstruct and pave a 12 foot wide, approximately 1370 feet long road on the landside toe of the right bank levee of the Feather River	Cutoff Wall		struc	4.0
375	9	655+50			Service Pole, Electrical Panel, Water Well, Pump, and irrigation facilities	Cutoff Wall	The water well is located within the proposed right-of-way for levee project. **Relocate outside of of the proposed right-of-way.**	well	
	8/9	654+75			Reach 8/9 Transition				
376	8	649+11	2,142,954.74	6,672,128.18	Construct #3/4 ACSR 12kv pole line across the right bank levee of the Feather River, approximately 1900 feet southerly from Messick Road extended easterly to the river. Extension to serve 50 HP agricultural pump for C.E. Sullivan	Cutoff Wall		EL	OH
377	8	647+74	2,142,830.08	6,672,119.48	Feather Water District North Pump Station 1-26" irrigation discharge pipes	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off structure and anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	1.6
378	8	647+70	2,142,826.16	6,672,118.89	Feather Water District North Pump Station 1-26" irrigation discharge pipes	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off structure and anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	1.3
379	8	647+66	2,142,822.01	6,672,118.27	Feather Water District North Pump Station 1-26" irrigation discharge pipes	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off structure and anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	1.4
380	8	647+61	2,142,817.52	6,672,117.60	Feather Water District North Pump Station 1-26" irrigation discharge pipes	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off structure and anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	1.3
381	8	638+20			Service Pole, Electrical Panel, Water Well, Pump, Sand Seperator, Concrete Pad, and irrigation facilities (20 feet west of levee toe)	Cutoff Wall	The water well is located within the proposed right-of-way for levee project. **Relocate outside of of the proposed right-of-way.**	well	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
382	8	622+79			Stand pipe, Service Pole, Electrical Panel, and Pump House, Water Well, and Pump at landside levee toe	Cutoff Wall	The water well does not meet Title 23 since too cloase to levee. The water well is located within the proposed right-of-way for levee project. **Relocate outside of of the proposed right-of-way.**	well	
383	8	622+79	2,140,350.59	6,671,955.66	Installation of a 12kv power line crossing of the right bank of the Feather River.	Cutoff wall		EL	OH
384	8	603+50			Service Pole, Electrical Panel, Water Well, Pump, Sand Seperator, Concrete Pad, and irrigation facilities (40 feet west of levee toe)	Cutoff wall	**Relocate outside of of the proposed right-of-way.**	well	
	7/8	596+00			Reach 7/8 Transition	Cutoff wall			
385	7	592+67	2,137,447.24	6,671,791.94	12 kv power line across levee	Cutoff wall		EL	OH
386	7	587+00	2,136,925.70	6,671,619.94	Spur Levee upstream of Abbott Lake	Cutoff wall		struc	
387	7				WS Slope varies from 3:1 near crown to 2:1 to 1:1 at toe. Sloughing and caving toe. Along slope I is hummocky; possibly from local slumping.	Cutoff wall		struc	
388	7				caving and slumping at toe. Rip rap berm toe. Diffcult to evaluate due to vegetation growth.	Cutoff wall		struc	
389	7	560+00			To fill in approximately one mile of an existing irrigation ditch at the waterside toe of the right bank of the Feather River.	Cutoff wall with existing relief wells	**Relocate outside of of the proposed right-of-way.**	Struc	
390	7				Bank caving 3 to 4 feet high, intermittent repair with rip rap berm at base of over steepened slope	Cutoff wall with existing relief wells		struc	
391	7	560+00			To construct a water well with a 14 inch casing in the right bank overflow of the Feather River at Abbott Lake	Cutoff wall with existing relief wells		well	
392	7	560+00			To extend approximately 2,500 of 12kv electric service line in the right bank overflow area of the Feather River near Abbott Lake to serve 25 HP Ag Pump for A.S. Cozzolino.	Cutoff wall with existing relief wells		EL	OH
393	7	557+00			Service Pole, Electrical Panel, Water Well, Pump, Sand Seperator, Concrete Pad, and irrigation facilities (50 feet west of levee toe)	Cutoff wall with existing relief wells	**Relocate outside of of the proposed right-of-way.**	well	
394	7	545+41	2,132,940.57	6,672,317.26	Crushed CMP Riser in Land Side Slope. Possible location of 8 inch steel pipe.	Cutoff wall with existing relief wells	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(A)	3.1
395	7	536+73	2,132,153.19	6,672,681.57	Existing 10 inch steel pipe. Removed in 1964 by Levee District No. 1 as part of permit 4775	Cutoff Wall		IR(?)	
396	7	536+64	2,132,149.73	6,672,692.81	5 inch steel drainage pipe	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SD(P)	2.0
397	7	532+00 to 596+00			Taylor Brothers. 15 Inch Irrigation Main located within 15 feet of landside toe	Cutoff Wall	The pipeline is within twenty (20) feet of the levee toe and does not meet Title 23. **Relocate outside of of the proposed right-of-way.**	IR (G)	
398	7	529+47	2,131,549.40	6,673,081.12	Abandon 6 inch pipe	Cutoff Wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	IR(A)	4.0
399	7	515+00			Seepage Interceptor Trench for Star Bend Relief Well Pumps	Cutoff Wall		struc	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
400	7	512+08	2,130,379.55	6,674,329.99	Corp of Engineers Star Bend Road Relief Well Pump Station north 15" Steel Discharge Pipe Crossings	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure installed. **Replace in accordance with USACE standard**	SD(P)	3.8
401	7	512+04	2,130,375.66	6,674,332.71	Corp of Engineers Star Bend Road Relief Well Pump Station south 15" Steel Discharge Pipe Crossings	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure installed. **Replace in accordance with USACE standard**	SD(P)	3.7
402	7	510+97	2,130,288.81	6,674,393.77	12 kv power line crossing of levee	Cutoff Wall		EL	OH
	6/7	510+37			Reach 6/7 Transition	Cutoff Wall			
403	6	510+50			To retain a 12 kv overhead service line and four power poles in the right bank overflow area of the Feather River.	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
404	6	510+36	2,130,239.19	6,674,428.41	Volcano Vista Farms 18 inch steel irrigation discharge pipe crossing of levee	Cutoff Wall		IR(P)	4.0
405	6	510+30			To install 20 hp irrigation pump and to retain an existing walnut orchard (35 acres) all on the right bank of the Feather. Now owned by Volcano Vista Farms and located on Tudor Mutual Pump Station (relocated pipeline part of permit 18438)	Cutoff Wall		IR(P)	
406	6	510+25	2,130,230.41	6,674,434.54	Tudor Mutual Water Company North 30 inch steel irrigation discharge pipes crossing of levee	Cutoff Wall		IR(P)	4.2
407	6	510+20	2,130,222.24	6,674,437.45	Tudor Mutual Water Company South 30 inch steel irrigation discharge pipes crossing of levee	Cutoff Wall		IR(P)	4.1
408	6				12 inch steel pipe through levee	Cutoff Wall	The conduit may meet title 23 requirements but will need to be replaced during cutoff wall construction. **Replace in accordance with USACE standard**		
409	6				12 kv power line crossing of levee	Cutoff Wall			
410	6				12 kv power line crossing including 9 power poles and 3 anchors (appears to cover permit 2502 and 5072)	Cutoff Wall			
411	6				Abandon 14 inch pipe (this pipeline removed as part of 2009 setback levee project). Listed as 10" Steel in original 1955 O&M manual.	Cutoff Wall	**Recommended Removal**	IR(P)	4.1
412	6	509+00			To construct approximately 1,400 lineal feet of filter trench adjacent to the right bank levee of the Feather River	Cutoff Wall		Struc	
413	6	508+00			To clear, level, and plant a peach orchard on approximately 170 acres on the right bank of the Feather River.	Cutoff Wall		Trees	
414	6				Fix in-place the existing levee with 65ft deep cutoff wall between station 478+68 and station 512+00	Cutoff Wall		struc	
	5/6	478+68			Reach 5/6 Transition	Cutoff wall with seepage berm			
415	5	475+00			To plant walnut orchard in the right overflow area of the Feather River downstream from Star Bend	Cutoff wall with seepage berm		Trees	
	5	461+00			Urban (200 year) North - Nonurban (100 year) South Transition	Cutoff wall with seepage berm			

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
416	5	460+11	2,125,845.57	6,676,268.36	Abandon 8" steel drainpipe. The CVFPB sent an encroachment violation notice on August 16, 2011 to Dan Stephens Trust.	Cutoff wall with seepage berm	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SD(P)	4.1
417	5	442+80	2,124,212.69	6676803.8	Abandon 8" steel drainpipe	Cutoff wall	The pipeline does not meet title 23 requirements and will need a positive shut-off structure installed and automatic drainage gate on waterside of levee. **Recommend Removal**	SD(P)	4.1
418	5	433+50	2,123,304.56	6,677,004.67	Power line across levee to service pole with meter on waterside slope of levee	Cutoff wall	**Relocate outside of of the proposed right-of-way.**	EL	OH
419	5	409+00 to 424+00			Taylor Brothers. 15 Inch Irrigation Main located within 15 feet of landside toe	Cutoff wall	The pipeline is within twenty (20) feet of the levee toe and does not meet Title 23. **Relocate outside of of the proposed right-of-way.**	IR (G)	
420	~~5~~	~~417+66~~	~~Not Verified~~		~~Abandon Existing 24 inch pipe through levee. The permit was revised to removal of 24 inch via 4666A so there should not be any pipe.~~	~~Cutoff wall~~		~~SD(G)~~	
	4/5	410+67			Reach 4/5 Transition	Cutoff wall			
421	4	410+53	2,121,173.09	66,776,661.21	Power line crossing to Feather Water District Pumps	Cutoff wall		EL	OH
422	4	409+84	2,121,105.29	6,677,660.77	To install a 2 inch electrical conduit through the levee. The conduit will be buried in the levee slopes and through the crown with one foot of cover. The conduit will provide electrical service to an existing pumping plant in the floodway of the Feather River.	Cutoff wall	The conduit may meet title 23 requirements but will need to be replaced during cutoff wall construction. **Replace in accordance with USACE standard**	EL	2.0
423	4	409+66	2,121,086.77	6,677,660.88	Feather Water District South Pump Station 1-18" irrigation discharge pipes. The improvements include a reservoir at the landside toe of levee and a inlet channel from river to waterside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure and new anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	0.8
424	4	409+62	2,121,082.47	6,677,660.77	Feather Water District South Pump Station 1-18" irrigation discharge pipes. The improvements include a reservoir at the landside toe of levee and a inlet channel from river to waterside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure and new anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	0.9
425	4	409+58	2,121,078.48	6,677,660.82	Feather Water District South Pump Station 1-18" irrigation discharge pipes. The improvements include a reservoir at the landside toe of levee and a inlet channel from river to waterside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure and new anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	0.8
426	4	409+55	2,121,075.08	6,677,660.80	Taylor Brothers Farm Irrigation Pump Station. A inclined pump located on the waterside slope of levee with 14 Inch Pipeline through levee	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure and new anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	1.4
427	4	409+50	2,121,069.88	6,677,660.77	Feather Water District South Pump Station 1-18" irrigation discharge pipes. The improvements include a reservoir at the landside toe of levee and a inlet channel from river to waterside toe.	Cutoff Wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure and new anti-siphon device installed. **Replace in accordance with USACE standard**	IR(P)	1.7
428	4	407+72	2,120,892.86	6,677,656.42	Abandoned pipe and structure at landside toe, pipe is 8 inch, but the headwall appears that it is ran through a larger older pipe possibly and old drainage pipe.	Cutoff Wall	The pipeline does not meet title 23 requirements and no longer in use. **Recommend Removal**	IR(A)	21.8
429	4	407+72	2,120,892.86	6,677,656.42	Taylor Brothers Production Water Well (facilities located at levee toe).	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	well	
430	4	396+32	2,119,752.28	6,677,651.86	8 inch pipe crossing. Headwall at land toe, art on land side of crown, and cut pipe near water side toe. CVFPB sent a notice of violation notice on October 4, 2011.	Cutoff Wall	The pipeline does not meet title 23 requirements and no longer in use. **Recommend Removal**	IR(P)	4.1
431	4	396+50 to 409+00			Taylor Brothers. 15 Inch Irrigation Main located within 15 feet of landside toe	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	IR (G)	

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
432	4	396+50 to 409+00			Feather Water District. 42 Inch Irrigation Main located within 10 feet of landside toe with standpipes	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	IR (G)	
433	4	396+20			Feather Water District Irrigation Production Well (facilities located 10 foot west of toe). CVFPB sent a notice of violation notice on October 4, 2011.	Cutoff Wall		well	
434	4	386+63	2,118,786.69	6,677,704.40	Abandon 8 inch pipe crossing, stand pipe on land toe has been destroyed. CVFPB sent a notice of violation on October 4, 2011.	Cutoff Wall	The pipeline does not meet title 23 requirements and no longer in use. **Recommend Removal**	IR(A)	4.6
435	4	365+00	2,116,703.78	6,678,265.36	Abandon 8 inch pipe crossing, stand pipe on land toe has been removed.	Cutoff Wall	The pipeline does not meet title 23 requirements and no longer in use. **Recommend Removal**	IR(A)	4.8
436	4	342+27	2,114,521.83	6,678,856.40	Irrigation Production Well (located xx foot west of levee toe)	Cutoff Wall	**Relocate outside of of the proposed right-of-way.**	well	
437	4	320+00			Approximately 500 horizontal feet of vertical excavation in the levee toe, cut 1 to 3 feet high. CVFPB sent out a encroachment violation notice on July 27, 2011 to Monasterio Family Trust.	Cutoff Wall		struc	
438	4	313+00			Approximately 100 horizontal feet of vertical excavation in the levee toe, cut about 3 feet high. Toe excavations are eroding and caving. CVFPB sent out a encroachment violation notice on September 12, 2011 to Monasterio Family Trust.	Cutoff Wall		struc	
	3/4	300+66			Reach 3/4 Transition				
439	3	298+89	2,110,314.83	6,679,535.86	Removal of a portion and filling with concrete a portion of an abandoned 36 inch steel pipe through the right bank levee of the Feather River	Cutoff wall	The pipeline does not meet title 23 requirements and no longer in use. **Recommend Removal**	IR(G)	
440	3	298+00			Approximately 600 horizontal feet of vertical excavation in the levee toe, cut 1 to 3 feet high. Toe excavations are eroding and caving. The CVFPB sent an encroachment violation notice on July 27, 2011 to Golden Gate Hop Ranch, Inc..	Cutoff wall		struc	
441	3	298+67	2,110,292.12	6,679,458.78	Garden Highway Mutual Water - Irrigation Production Well #23 (located 30 foot west of levee toe)	Cutoff wall		IR(W)	
442	3	298+38	2,110,262.81	6,679,553.51	Garden Highway Mutual Water 54 inch Irrigation Pump Station Discharge Pipeline through Levee. The improvements include a inlet channel from the river to the 200 feet from waterside toe of levee and irrigation canal at the toe of the landside of levee.	Cutoff wall	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure installed and new pipe. **Replace in accordance with USACE standard**	IR(G)	25.1
	3	280+90			State Maintenance Area 3 / Levee District No. 1 Levees Transition	Cutoff wall			
443	3	279+50			Garden Highway Mutual Water - Irrigation Production Well #4 (located 90 foot west of levee toe)	Cutoff wall		IR(W)	
444	3	274+50			Garden Highway Mutual Water - Irrigation Production Well #22 (located 20 foot west of levee toe)	Cutoff wall	The water well is located within the proposed right-of-way for levee project. **Relocate outside of of the proposed right-of-way.**	IR(W)	
445	3	241+75			Garden Highway Mutual Water - Irrigation Production Well #18 (located 50 foot west of levee toe)	Cutoff wall		IR(W)	
446	3	219+00			Garden Highway Mutual Water - Irrigation Production Well #19 (located 90 foot west of levee toe)	Cutoff wall with seepage berm		IR(W)	
447	3	219+00			12 inch pipe. Appears to be removed by pipe laying on ground adjacent to location	Cutoff wall with seepage berm	The pipeline does not meet title 23 requirements and no longer in use. **Recommend Removal**	IR(A)	
	2/3	218+66			Reach 2/3 Transition				
448	2	209+89	2,101,737.07	6,678,031.40	Electrical service crossing for pump	Cutoff wall with seepage berm	**Relocate outside of of the proposed right-of-way.**	EL	OH

TABLE 5-3 ALTERNATIVE SB8 - LEVEE ENCROACHMENT LIST

Item No.	Reach	STA	Location (NAD 83) Northing	Location (NAD 83) Easting	Encroachment	Proposed Levee Improvement	Required Improvement Work	Type	cover
449	2	209+23	2,101,673.35	6,678,014.21	Kuster Private Irrigation Pump Station. 14 inch welded steel pipe crossing	Cutoff wall with seepage berm	The pipeline does not meet title 23 requirements. The crossing will need a positive shut-off device and structure installed and new pipe. **Replace in accordance with USACE standard**	IR(P)	3.0
450	2	217+00			National Audubon Society. To plant approximately 4,000 native trees on 40 acres within the right bank overflow area of the Feather River.	Cutoff wall with seepage berm		Trees	
451	2	217+00			National Audubon Society. To plant approximately 300 to 500 native trees (primarily cottonwoods) on the right bank overflow area of the Feather River.	Cutoff wall with seepage berm		Trees	

Type 1A - Removal & Disposal of Abandoned Raised Pipe

Type 1B - Removal & Disposal of Abandoned Through Pipe

Type 2A - Removal & Replace of Raised Pipe

Type 2B - Removal & Replace of Through Pipe

Type 3A - Removal & Replace of Raised Pipe Adjacent to Canal

Type 3B - Removal & Replace of Through Pipe Adjacent to Canal

Type 3C - Removal & Replace of Through Pipe Under Canal

Vegetation ETL Compliance

Relocation of Utility/Structure Outside of The Proposed ROW

Additional Works

Not Applicable/No Rehabilitation Required

SD(G)	Storm Water - Gravity
SD(P)	Storm Water - Pressure
SS (G)	Waste Water - Gravity
SS (P)	Waste Water - Pressure
IR(G)	Irrigation Line - Gravity
IR(P)	Irrigation Line - Pressure
RW (P)	Raw Water - Pressure
W(P)	Water Line - Pressure
RD	
GL	Gas Line
TL	Telephone Line
EL	Electrical Line
SEEP	
STRUC	Structure

Table 5-4A Summary of Construction Contracts for Alternative SB8

Features	Contract A Reach 2A-North to 5 180+00 to 478+68 2022 - 2023	Contract SBFIP Reach 6 478+68 to 512+00 2021 – 2022	Contract B Reach 7 to 12 512+00 to 845+00 2021 - 2022	Contract C1 Reach 13 to 18 845+00 to 1213+85 2017 – 2018	Contract C2 Reach 19 to 25 1213+85 to 1674+37 2018 – 2019	Contract D1 Reach 26 to 33 1674+37 to 2122+00 2019 – 2020	Contract D2 Reach 34 to 41 2122+00 to 2638+00 2020 - 2021
No Rehabilitation Required	N/A	N/A	1,300LF	14,930LF	4,800LF	4,390LF	2,800LF
Cutoff Wall Only	22,200LF	3,340LF	26,150LF	11,490LF	36,680LF	30,910LF	16,800LF
Jet Grouting Cutoff Wall Only	N/A	N/A	N/A	560LF	N/A	400LF	N/A
Seepage Berm Only	N/A	N/A	N/A	350LF	N/A	NA	5,000LF
Cutoff Wall with Full Levee Degrade	N/A	N/A	N/A	N/A	600LF	NA	N/A
Cutoff Wall with Full Levee Degrade and Existing Relief Wells	N/A	N/A	N/A	5,300LF			
Cutoff Wall with Existing Relief Wells	N/A	N/A	3,300LF	2,630LF	N/A	NA	N/A
Cutoff Wall with New Relief Wells (22 Wells)	N/A	N/A	2,500LF	N/A	N/A	NA	N/A
Cutoff Wall with Seepage Berm	7,670LF	N/A	N/A	N/A	N/A	NA	N/A
Cutoff Wall with Levee Relocation	N/A	N/A	N/A	N/A	3,610LF	8,000LF	N/A
Cutoff Wall with Sutter Butte Canal Relocation	N/A	N/A	N/A	N/A	370LF	1,170LF	N/A
Cutoff Wall with Landside Toe Fill	N/A	N/A	N/A	1,870LF	N/A	NA	N/A
DSM Cutoff Wall (subpart of the Cutoff Wall Only area)	2,000LF	N/A	N/A	2,630LF	2,400LF	5,580LF	7,180LF
Erosion Protection	N/A	N/A	5,760LF	N/A	1,900LF	NA	N/A
Utilities & Encroachments (Total, Table 5-4B)	37	12	46	129	86	94	47
Utilities & Encroachments (To be modified, Table 5-4B)	27	4	19	53	37	52	31
Land Acquisition							
Number of Impacted Parcel							
Number of Potential Structural Demolition							
Closure Structure	N/A	N/A	N/A	1	N/A	N/A	N/A

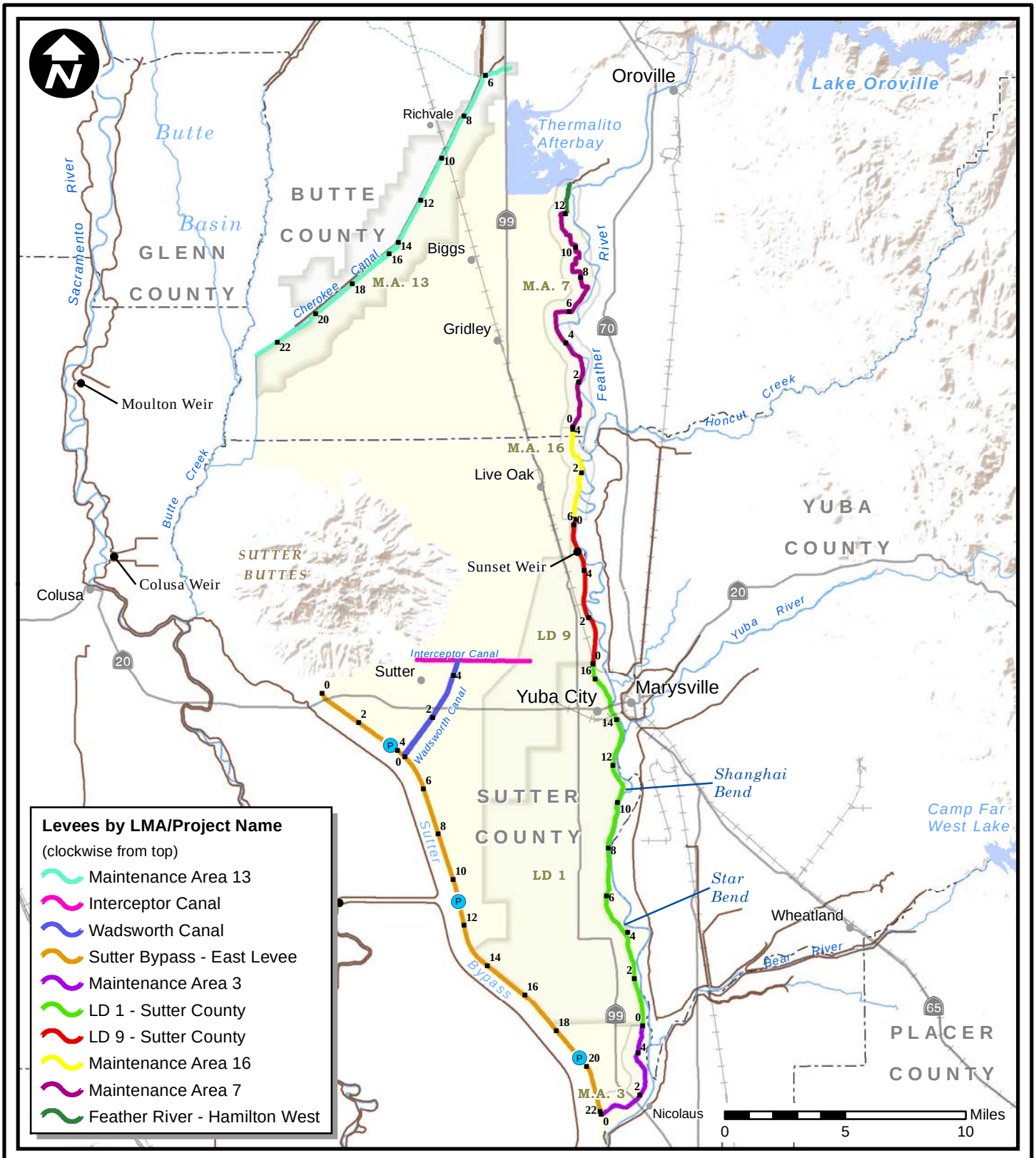
Table 5-4B Summary of Utilities & Encroachments for Construction Contracts

Color Codes	Types of Remediation		Construction Contracts						
		Alt. SB8	**A**	**SBFIP**	**B**	**C1**	**C2**	**D1**	**D2**
		Item No. 1 - 451	Item No. 415 - 451	Item No. 403 - 414	Item No. 357 - 402	Item No. 228 - 356	Item No. 142 - 227	Item No. 48 - 141	Item No. 1 - 47
	Type 1A - Removal & Disposal of Abandoned Raised Pipe	**21**	6	0	3	6	4	2	0
	Type 1B - Removal & Disposal of Abandoned Through Pipe	**12**	2	0	0	1	1	5	3
	Type 2A - Removal & Replace of Raised Pipe	**57**	7	0	9	25	6	6	4
	Type 2B - Removal & Replace of Through Pipe	**24**	1	0	0	0	3	9	11
	Type 3A - Removal & Replace of Raised Pipe Adjacent to Canal	**1**	0	0	0	0	0	1	0
	Type 3B - Removal & Replace of Through Pipe Adjacent to Canal	**3**	0	0	0	0	0	3	0
	Type 3C - Removal & Replace of Through Pipe Under Canal	**4**	0	0	0	0	1	3	0
	Vegetation ETL Compliance	**26**	3	1	0	0	12	10	0
	Relocation of Utility/Structure Outside of The Proposed ROW	**57**	8	1	7	18	9	9	5
	Additional Works	**18**	0	2	0	3	1	4	8
	Not Applicable/No Rehabilitation Required	**228**	10	8	27	76	49	42	16
Total Number of Utilities & Encroachments		**451**	37	12	46	129	86	94	47
Total Number of Utilities & Encroachments To Be Modified		**223**	27	4	19	53	37	52	31

Table 5-5 Borrow Sites and Usage for SB-8	**Volume of Material (Potential)**		
Borrow Sites and Usage	Type 1 (cy)	Type 2 (cy)	Random (cy)
2 - CDFG (OWA - Cobble Borrow)			330,800
Leftover after using borrow for D2			151,280
3 - Live Oak Detention Basin	150,000		
Leftover after using borrow for D2 - as Type 1	92,150		
Leftover after using borrow for D1 - as Type 1	0		
4 - Lanza 235 Borrow	250,000		
Leftover after using borrow for D1 - as Type 1	233,250		
Leftover after using borrow for D1 - as Type 2	62,850		
Leftover after using borrow for C2 - as Type 1	0		
5 - Nevis Property	250,000		
Leftover after using borrow for C2 - as Type 1	217,450		
Leftover after using borrow for C2 - as Type 2	143,550		
Leftover after using borrow for C1 - as Type 1	25,595		
Leftover after using borrow for C1 - as Type 2	12,252		
7 - Lanza 620 Acres Property	119,932	359,796	
Leftover after using borrow for A - as Type 1	948		
Leftover after using borrow for A - as Type 2		19,986	
8 - Huston Property	330,000		
Leftover after using borrow for B - as Type 1	199,279		
Leftover after using borrow for B - as Type 2	33,687		
11 - Siller Live Oak Property	250,000		
12 - Siller Yuba City Property		100,000	
Leftover after using borrow for SBFIP - as Type 2		53,200	
Total Potential	1,349,932	459,796	330,800

Table 5-6 Borrow Demand for SB-8	**Volume of Material (Demand)**		
Construction Contracts and Usage	Type 1 (cy)	Type 2 (cy)	Random (cy)
CONTRACT A	118,984	339,810	
Unknown (7 or within vicinity R of the contract)	118,984	339,810	
CONTRACT STAR BEND (SBFIP)		46,800	
12 - Siller Yuba City Property		46,800	
CONTRACT B	130,721	165,592	
8 - Huston Property	130,721	165,592	
CONTRACT C1	117,955	13,343	
5 - Nevis Property	117,955	13,343	
CONTRACT C2	95,400	73,900	
4 - Lanza 235 Borrow	62,850		
5 - Nevis Property	32,550	73,900	
CONTRACT D1	108,900	170,400	
3 - Live Oak Detention Basin	92,150		
4 - Lanza 235 Borrow	16,750	170,400	
CONTRACT D2	57,850		179,520
2 - CDFG (OWA - Cobble Borrow)			179,520
3 - Live Oak Detention Basin	57,850		
Total Demand	629,810	809,845	179,520

PLATES



Legend

- Study Area Extent
- Levee Maintenance Agency
- Federal Levee
- Levee Mile
- Pump Station
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX

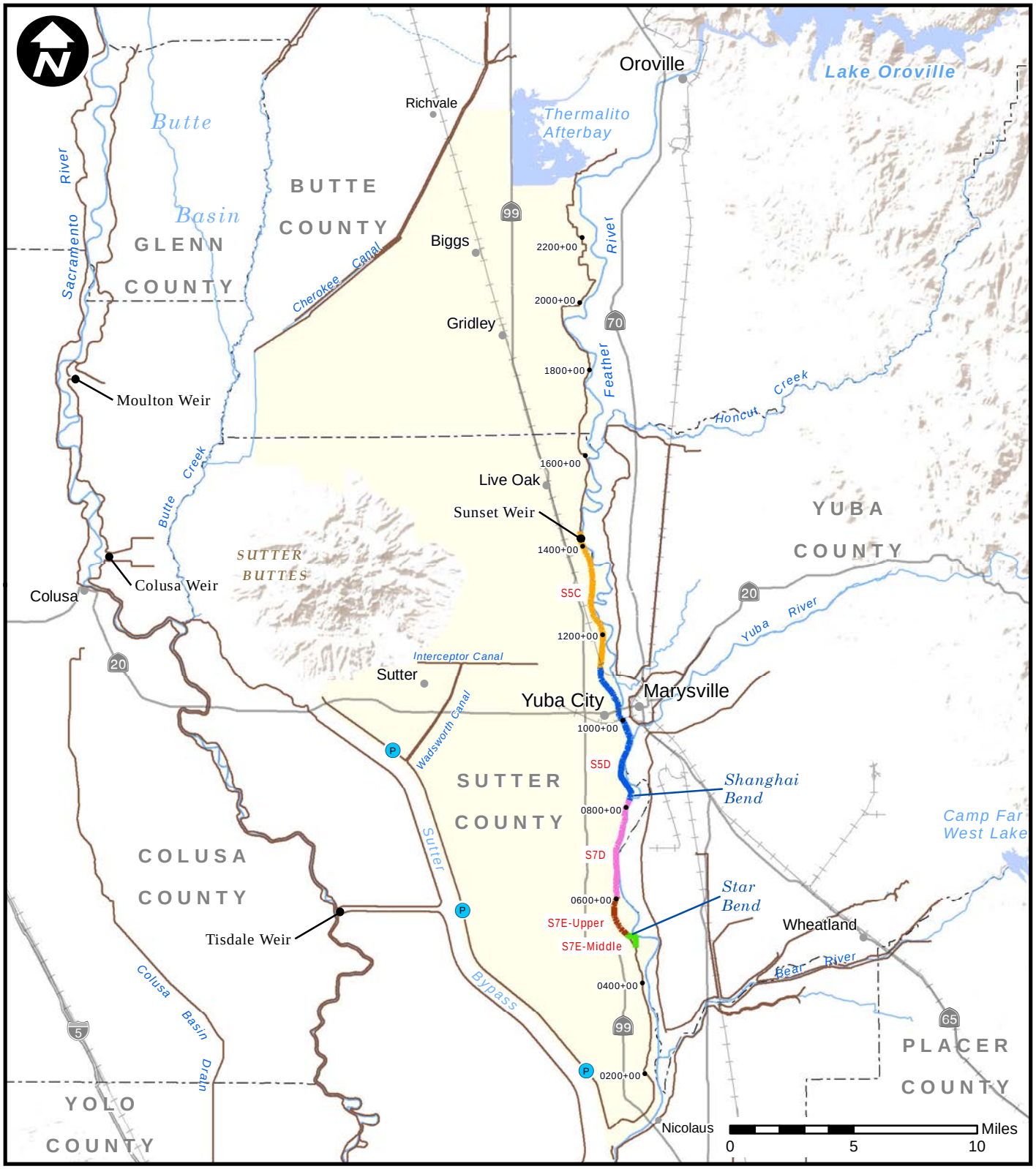
SUTTER BASIN PROJECT AREA

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by Jim Mars

APR 2013

PLATE 1-1



Legend

- Study Area Extent
- S5B Project Reach
- Federal Levee
- Stationing Point
- Pump Station
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX

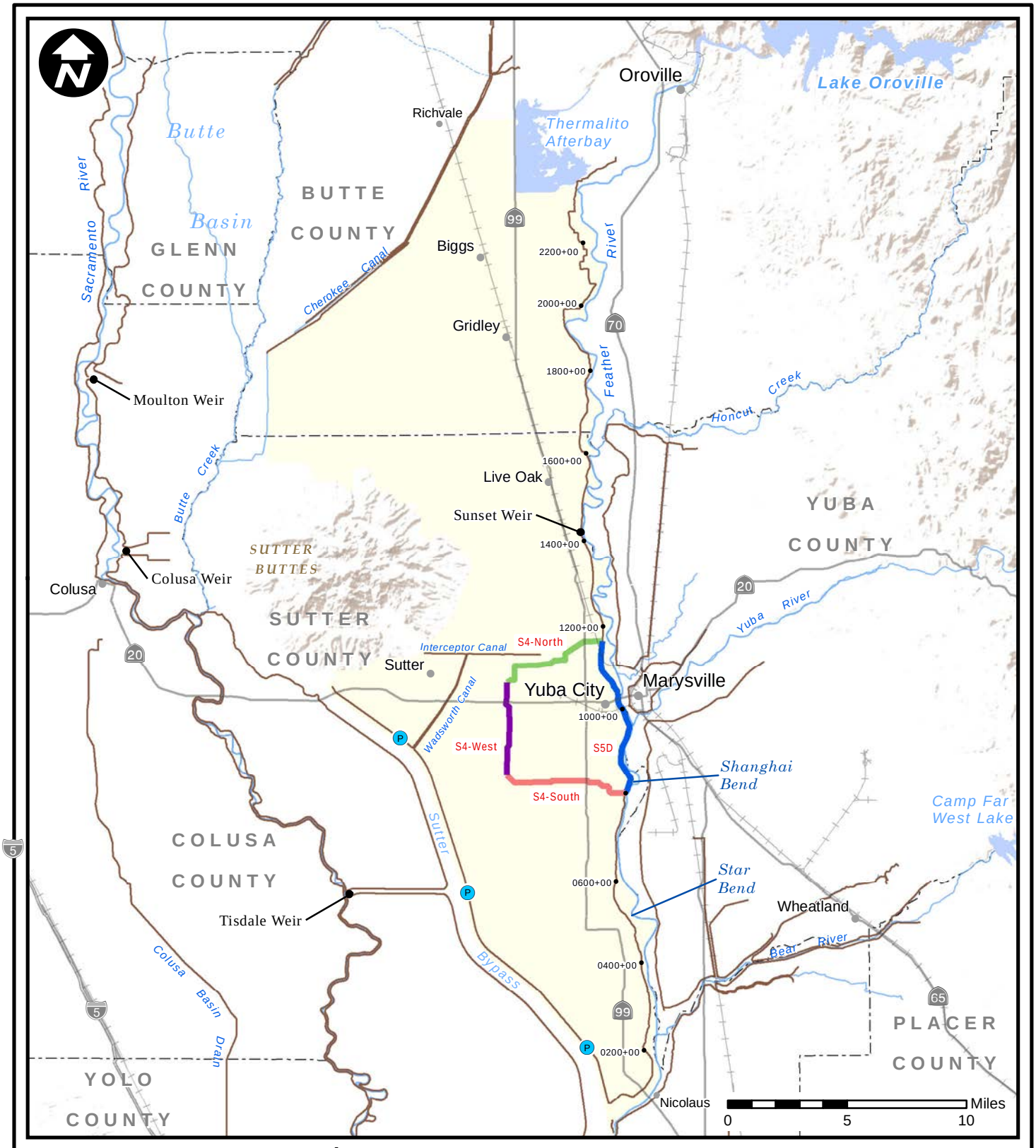
ALTERNATIVE SB-2: MINMAL FIX-IN-PLACE FEATHER RIVER LEVEES: SUNSET WEIR TO STAR BEND

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by Jim Mars

APR 2013

PLATE 1-2



Legend

- Study Area Extent
- Project Reach (S5B)
- Federal Levee
- Stationing Point
- Pump Station
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX

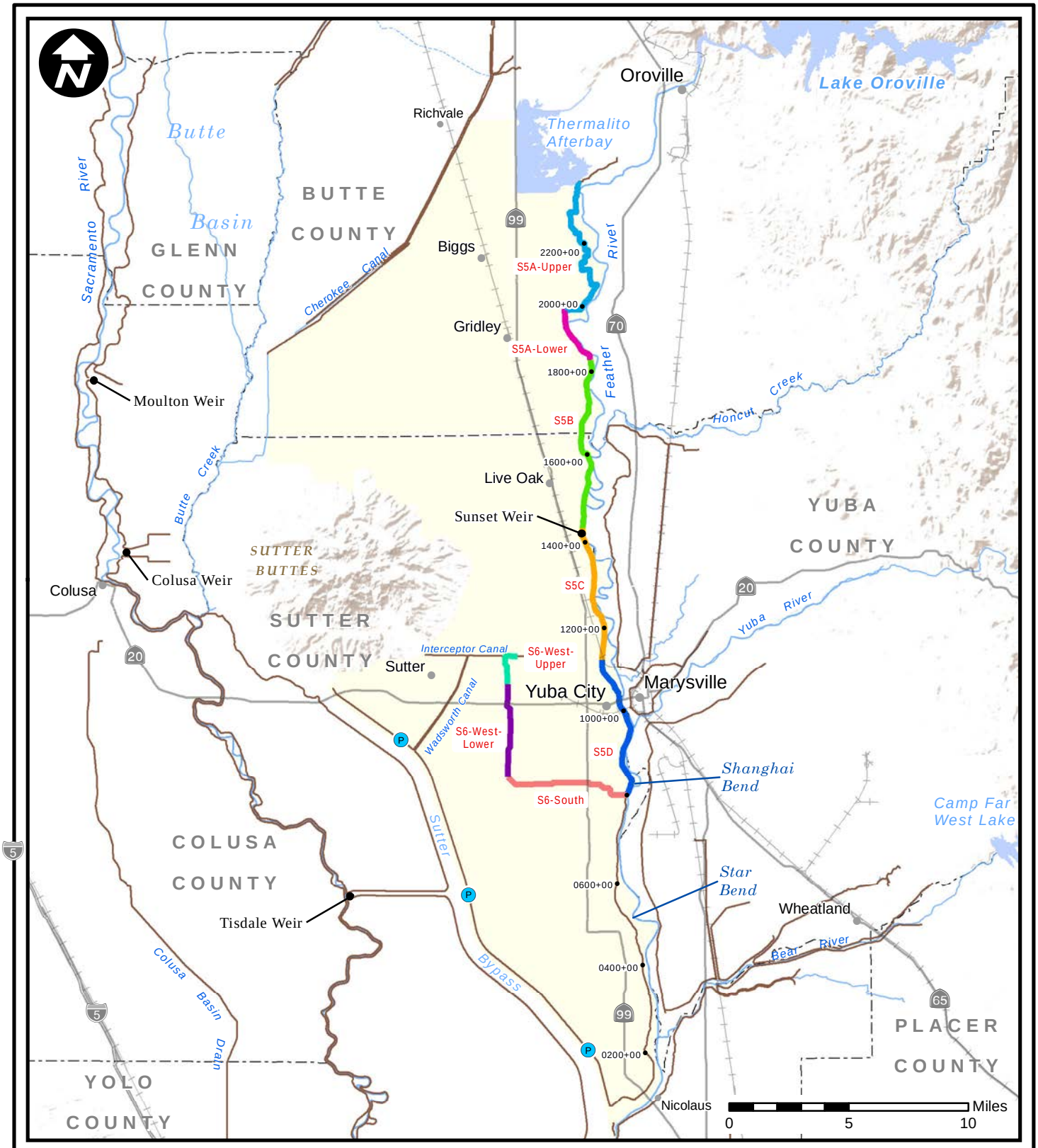
ALTERNATIVE SB-3: YUBA CITY RING LEVEE

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by Jim Mars

APR 2013

PLATE 1-3



Legend

- Study Area Extent
- Project Reach (S5B)
- Federal Levee
- Stationing Point
- Pump Station
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX

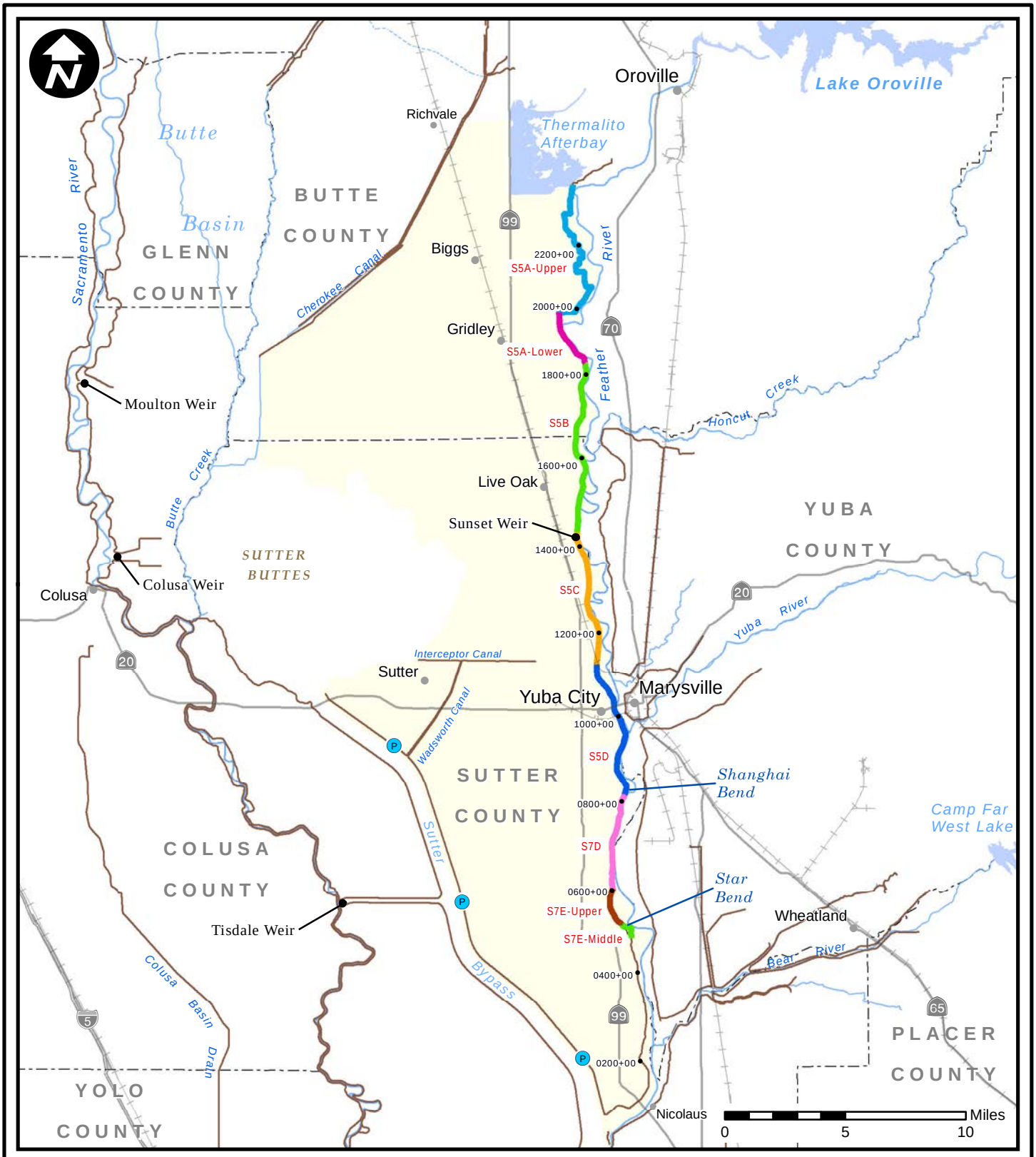
ALTERNATIVE SB-4: LITTLE J LEVEE

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by Jim Mars

APR 2013

PLATE 1-4



Legend

- Study Area Extent
- S5B Project Reach
- Federal Levee
- Stationing Point
- Pump Station
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX

ALTERNATIVE SB-5: FIX-IN-PLACE FEATHER RIVER LEVEES: THERMAILTO TO STAR BEND

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by Jim Mars

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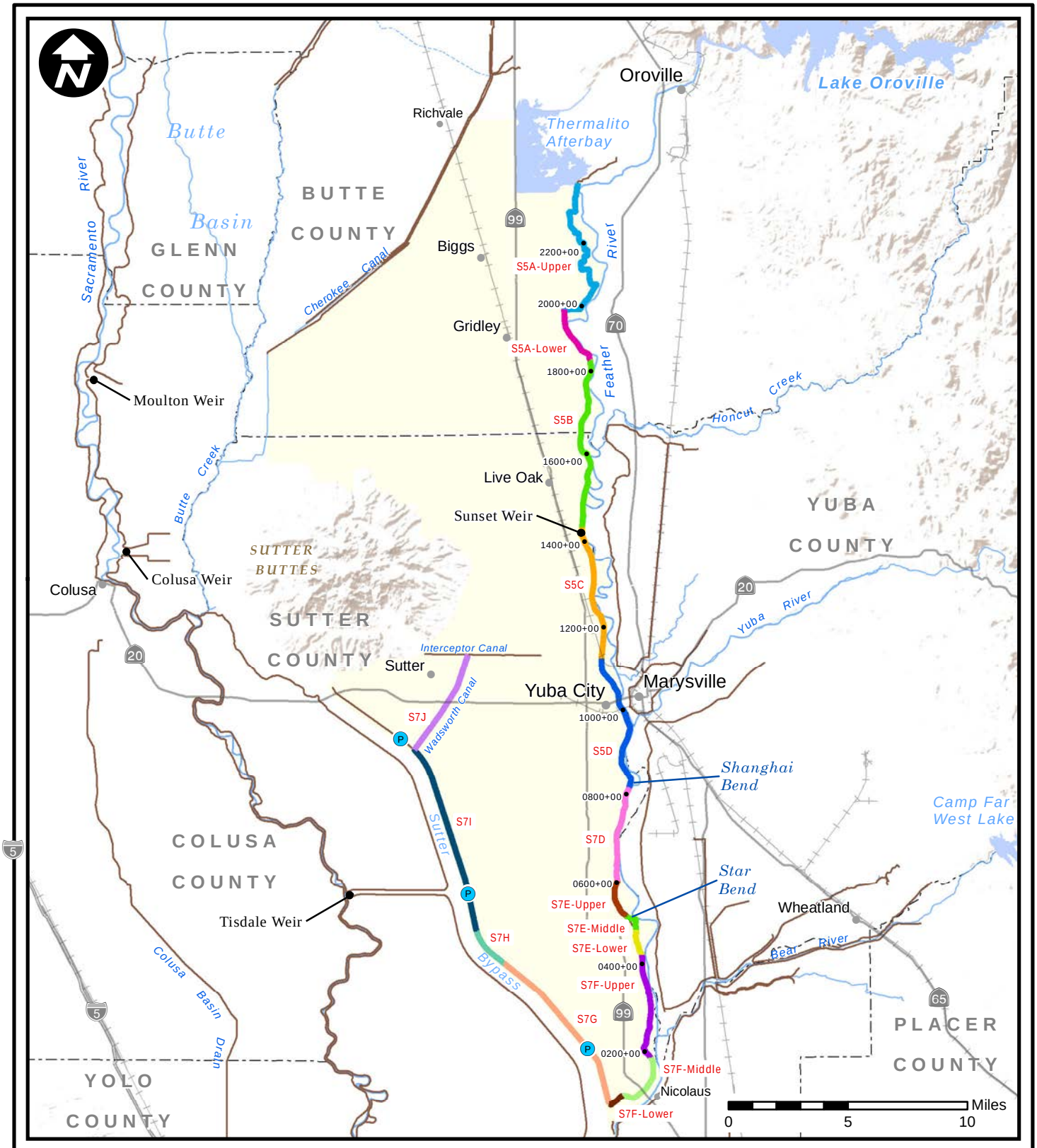
PLATE 1-5



Legend

- Study Area Extent
- Project Reach (S5B)
- Federal Levee
- Stationing Point
- Pump Station (P)
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX

ALTERNATIVE SB-6: FIX-IN-PLACE FEATHER RIVER, SUTTER BYPASS, AND WADSWORTH CANAL LEVEES

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by Jim Mars

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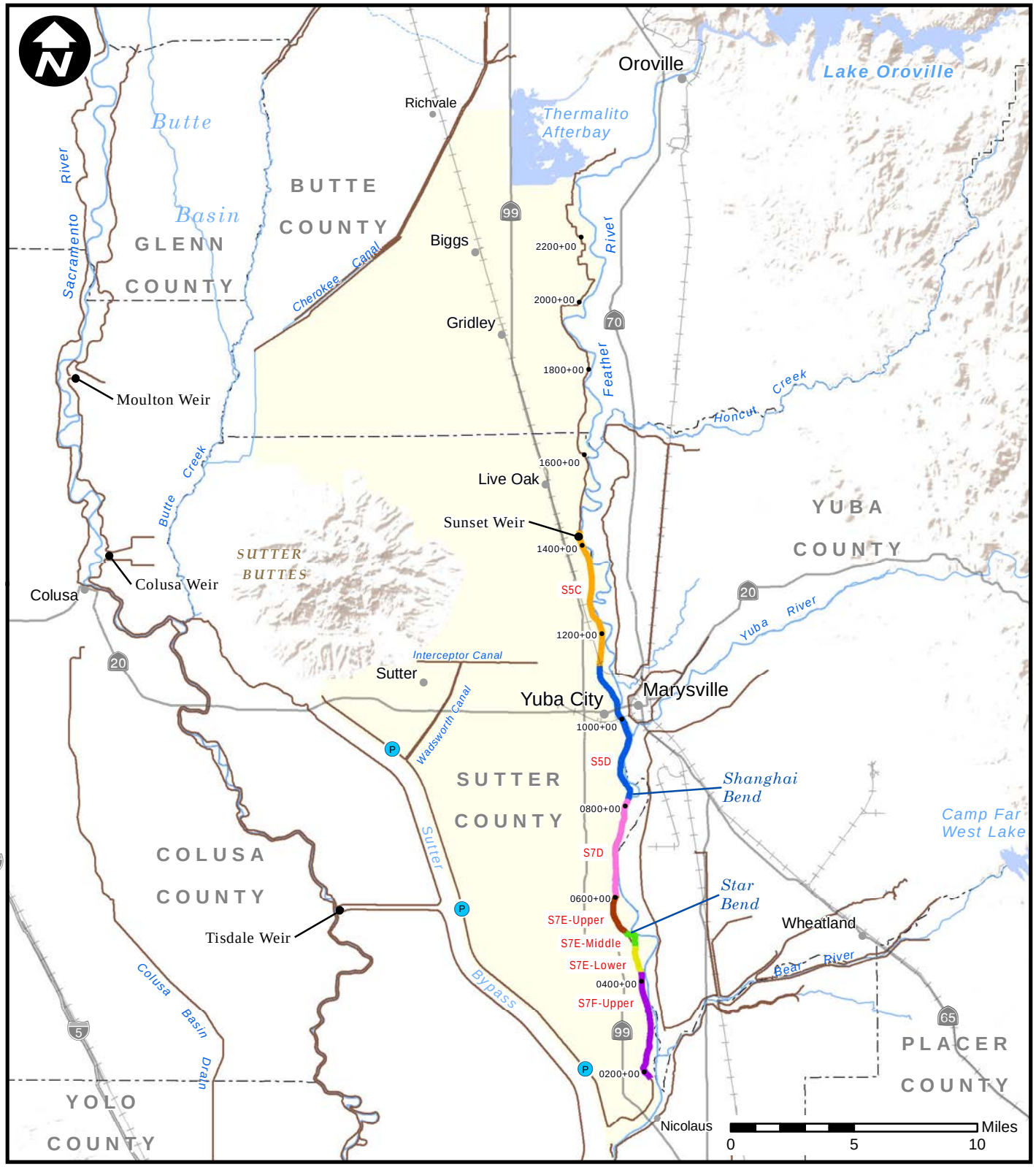
PLATE 1-6



Legend

- Study Area Extent
- Project Reach (S5B)
- Federal Levee
- Stationing Point
- Pump Station (P)
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX

ALTERNATIVE SB-7: FIX-IN-PLACE FEATHER RIVER LEVEES: SUNSET WEIR TO LAUREL AVE

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SACRAMENTO DISTRICT

Prepared by Jim Mars

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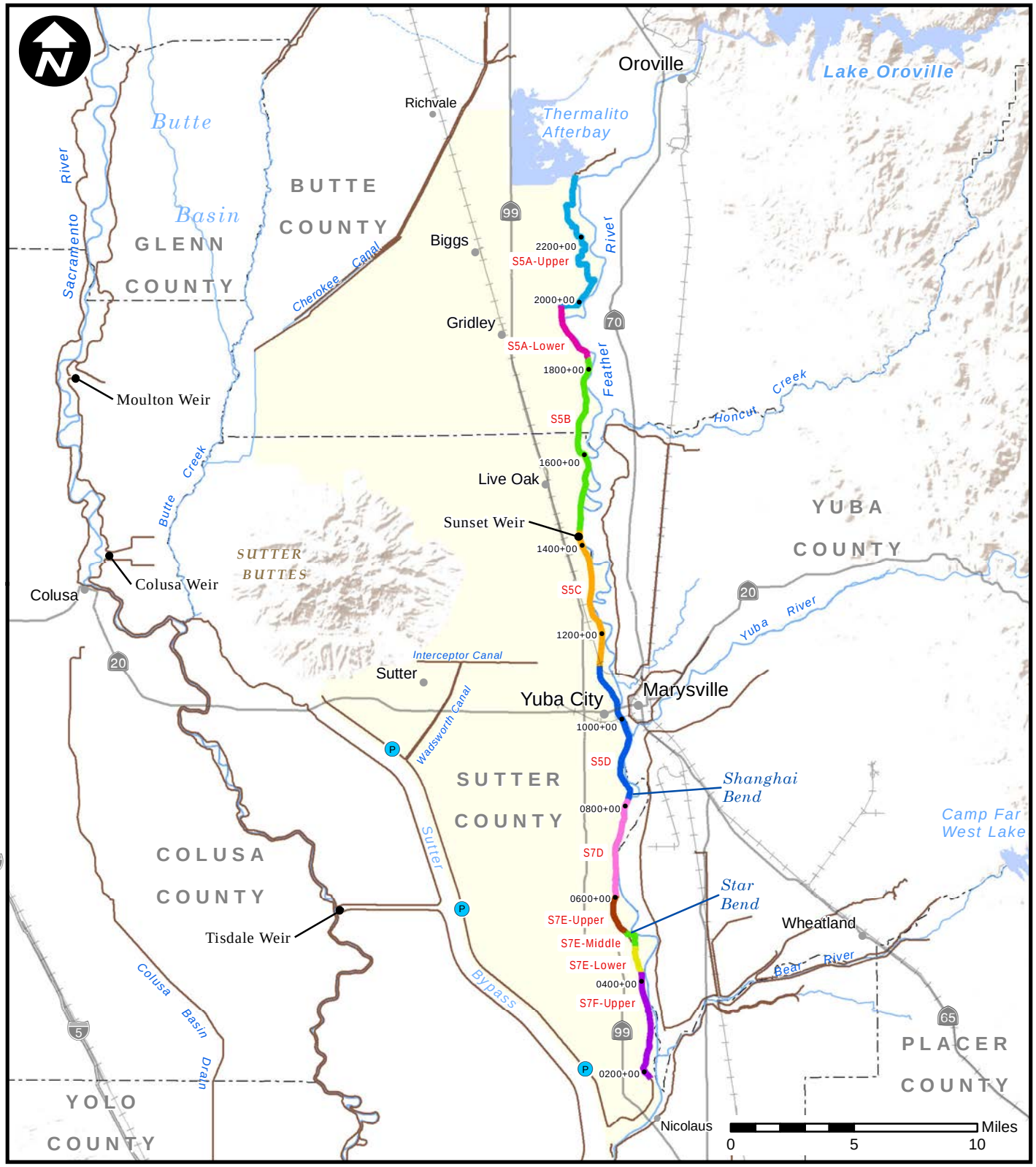
PLATE 1-7



Legend

- Study Area Extent
- S5B Project Reach
- Federal Levee
- Stationing Point
- Pump Station
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX

ALTERNATIVE SB-8: FIX-IN-PLACE FEATHER RIVER LEVEES: THERMALITO TO LAUREL AVE

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SACRAMENTO DISTRICT

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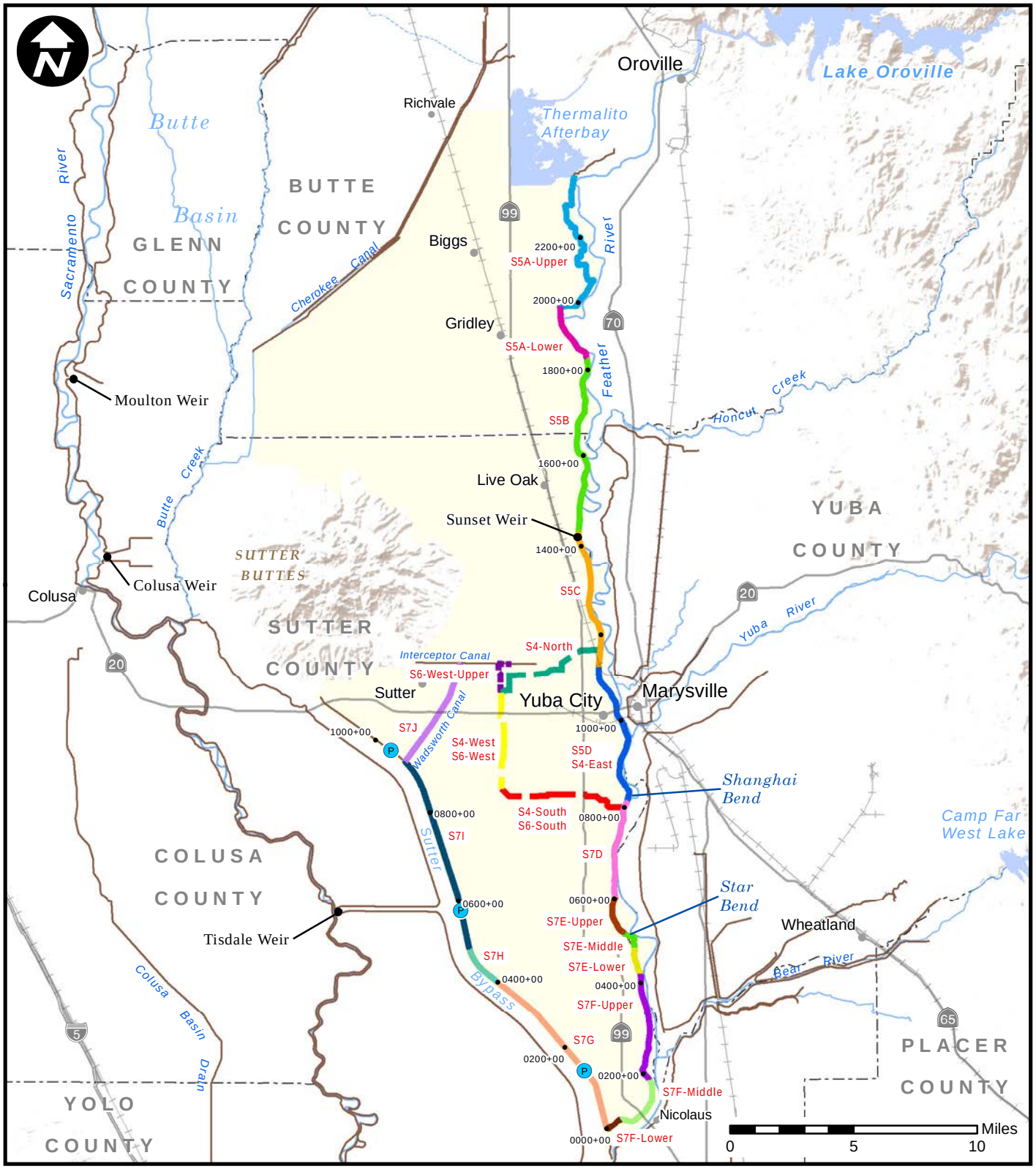
PLATE 1-8



Legend

- Study Area Extent
- Project Reach (S5B)
- Federal Levee
- Stationing Point
- Pump Station (P)
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX

PROJECT REACHES FOR CONCEPTUAL ALTERNATIVES

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SACRAMENTO DISTRICT

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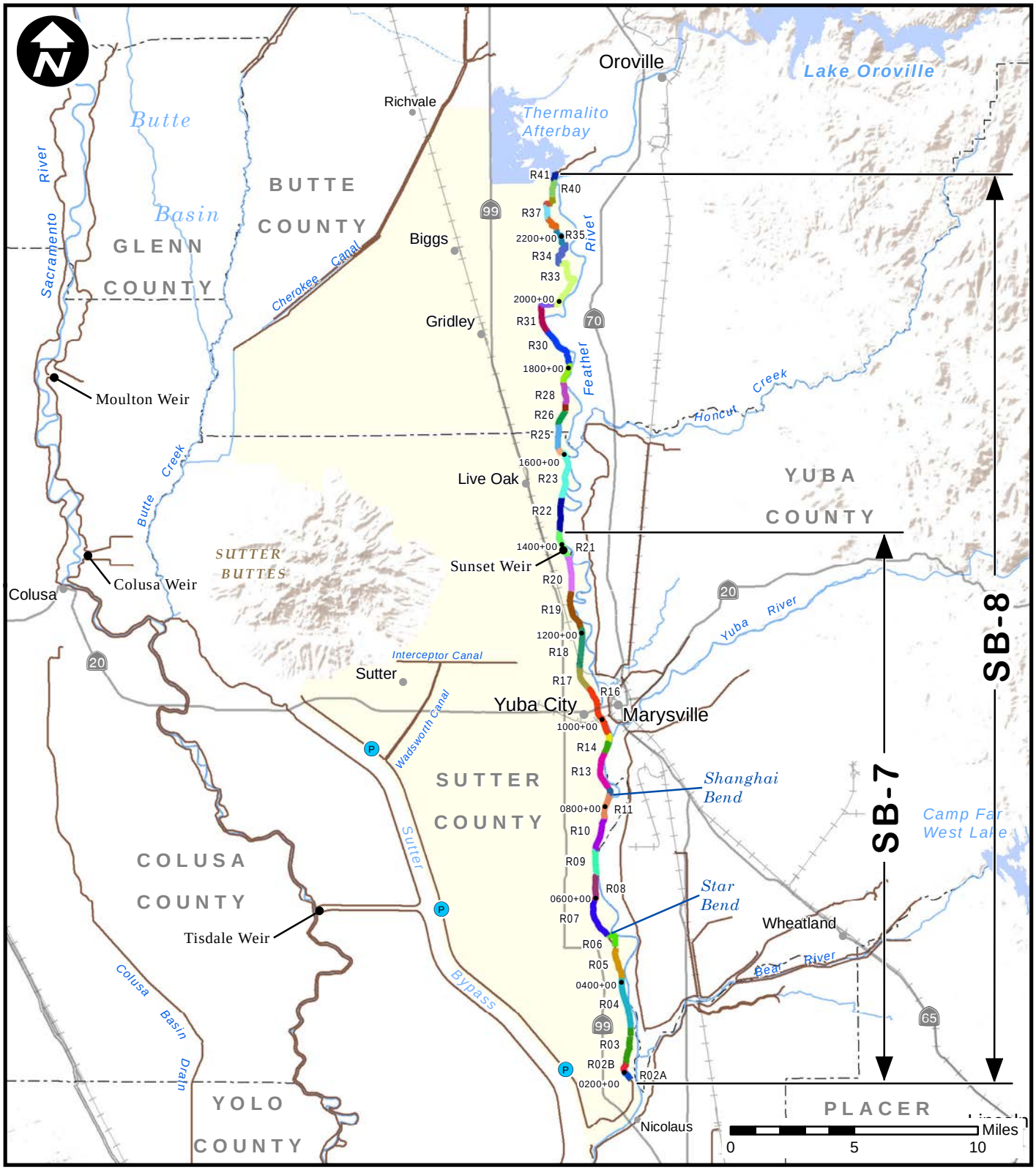
PLATE 2-1



Legend

- Study Area Extent
- Project Reach (R5)
- Federal Levee
- Stationing Point
- Pump Station (P)
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
SUTTER BASIN, CALIFORNIA

PROJECT REACHES FOR FINAL ALTERNATIVES

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by Jim Mars

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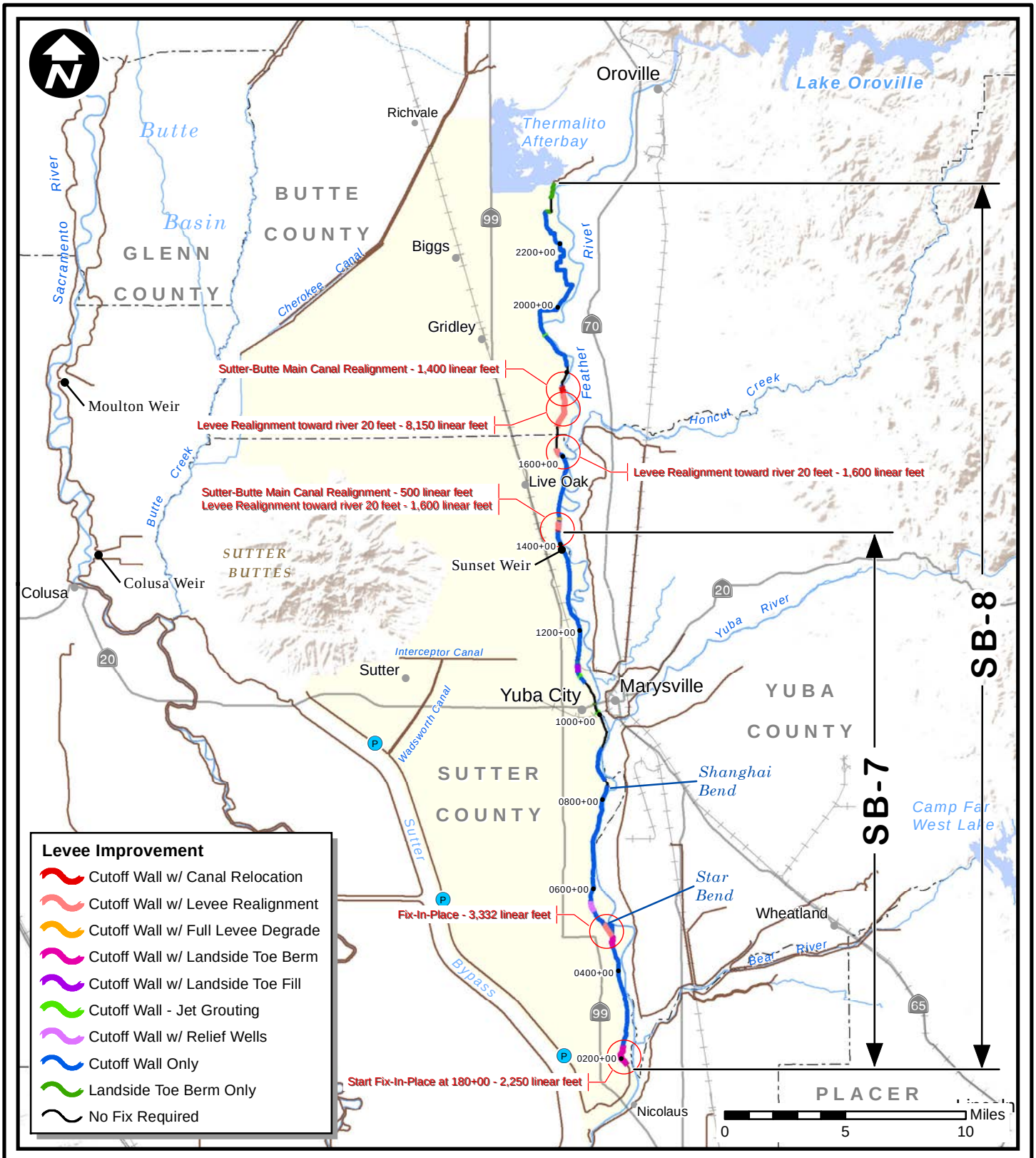
PLATE 2-2



Legend

- Levee Improvement Site
- Study Area Extent
- Federal Levee
- Stationing Point
- Pump Station
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX

LEVEE IMPROVEMENTS FOR FINAL ALTERNATIVES

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by Jim Mars

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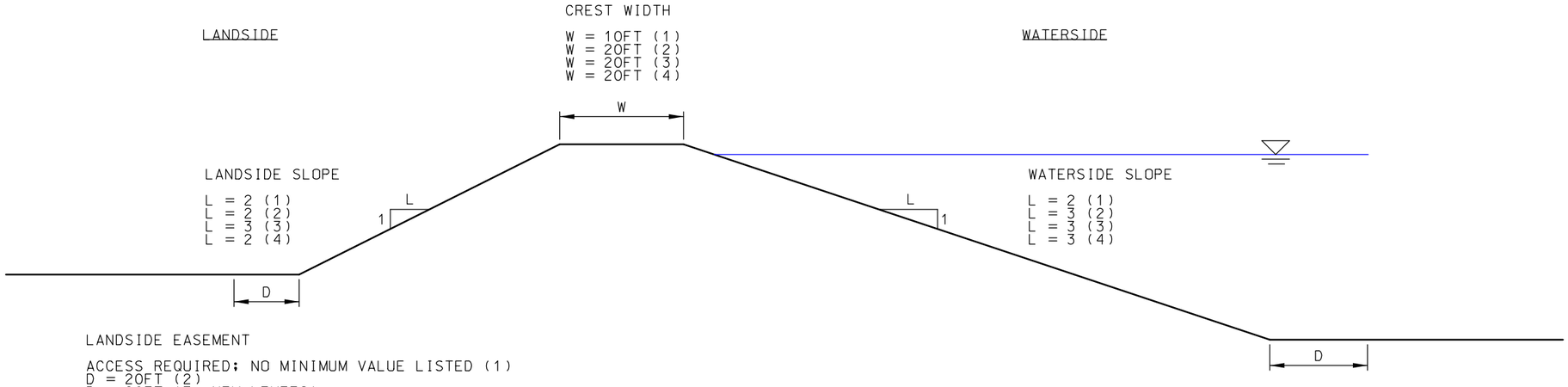
PLATE 2-3



LANDSIDE EASEMENT

ACCESS REQUIRED; NO MINIMUM VALUE LISTED (1)
D = 20FT (2)
D = 20FT (3, NEW LEVEES)
D = 10 - 20FT (3, EXISTING LEVEES)
D = 10FT (4)

WATERSIDE EASEMENT

D = 15FT (2)
D = 15FT (3)

REFERENCES

(1) EM 1110-2-1913, DESIGN & CONSTRUCTION OF LEVEES, APRIL 2000
(2) SPK, GEOTECHNICAL LEVEE PRACTICE (REFP10L0 OR SOP3), 11 APRIL 2008
(3) DWR, URBAN LEVEE DESIGN CRITERIA, MAY 2012 (NEW LEVEES, EXCEPTIONS MAY BE ALLOWED FOR RECONSTRUCTION OF EXISTING LEVEES
(4) CCR TITLE 23, WATERS DIVISION 1, CVFPB REGULATIONS, 22 JAN 2010

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Dwn by: TUNG LE
Reviewed by:
Submitted by:
CHIEF, CIV ENGR DES SEC A

Date: -
Spec No.: -
Drawing Code: -
File name: Plot date: 28-MAR-2013
Plot scale: -
Rev. -

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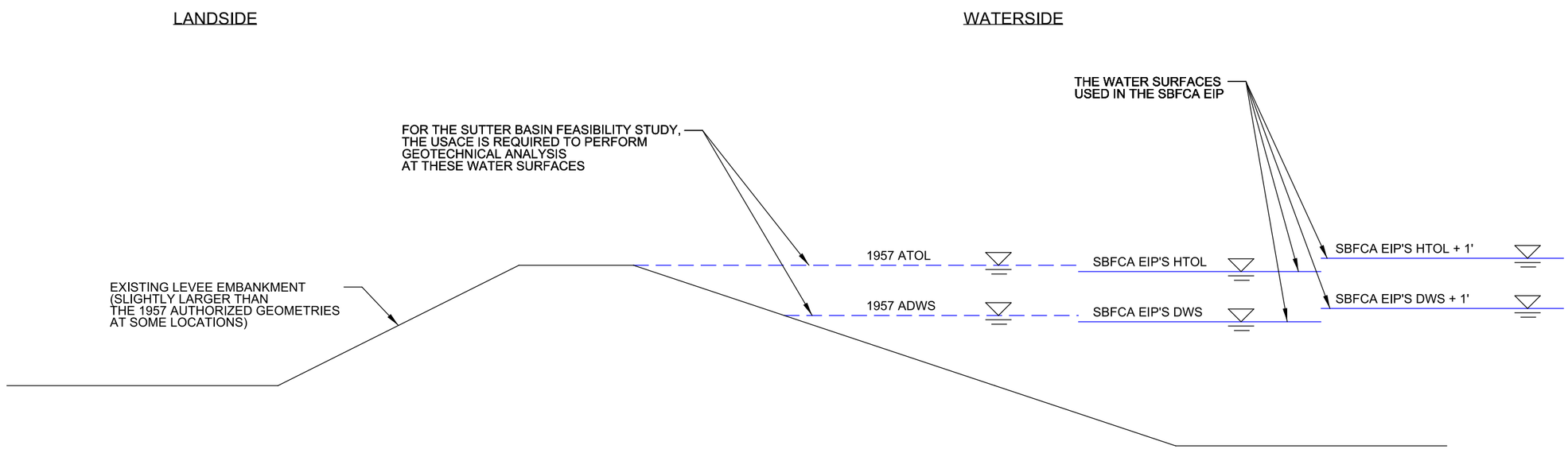
SUTTER BUTTE COUNTY CALIFORNIA
SUTTER BASIN FEASIBILITY STUDY
ENGINEERING APPENDIX

PLATE 2-4
TYPICAL LEVEE GEOMETRIES
MINIMUM REQUIREMENTS

Sheet reference number: -

Sheet - of -

AM-XX



(NOT TO SCALE)

1957 ADWS: THE 1957 AUTHORIZED DESIGN WATER SURFACE
1957 ATOL: THE 1957 AUTHORIZED TOP OF LEVEE

SBFCA: SUTTER BUTTE FLOOD CONTROL AGENCY
EIP: EARLY IMPLEMENTATION PROJECT
SBFCA EIP'S DWS: THE "DESIGN" WATER SURFACE USED IN THE SBFCA EIP
SBFCA EIP'S HTOL: THE "HYDRAULIC TOP OF LEVEE" WATER SURFACE USED IN THE SBFCA EIP

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Spec No.: -
Design file no: -
Drawing Code: -
Rev.: -
File name: Plot scale: 28-MAR-2013
MCACES SEC A

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SUTTER BUTTE COUNTY CALIFORNIA
SUTTER BASIN FEASIBILITY STUDY
ENGINEERING APPENDIX

PLATE 2-5
CURRENT AUTHORIZATION & GEOTECHNICAL ANALYSIS

Sheet reference number:
—
Sheet - of -
AM-XX

SUTTER BUTTE FLOOD CONTROL AGENCY FEATHER RIVER
WEST LEVEE PROJECT
PROPOSED NOMENCLATURE AND PROJECT APPROACH TO LEVEE ENCROACHMENTS

Levee Encroachment
All Utilities and Structures Within the Levee Footprint or Project Right-of-Way (ROW) Limits

Levee Prism Encroachment[1]
Encroachment Located Within the Levee Prism

Levee Prism Structure Encroachment[3]
- Retaining Wall
- Railroad Tracks
- Home
- Shed
- Roadway/Bridge

Levee Prism Wet Utility Encroachment[3]
- Pump Discharge Line
- Gravity Drainage Pipeline
- Sewer Outfall
- Natural Gas Pipeline
- Ag Turnout

Levee Prism Dry Utility Encroachment[3]
- Telephone Cable
- Overhead Power
- Fiber Optic Cable

ROW Encroachment[1]
Encroachment Located Within Project ROW Limits[2] Only

ROW Structure Encroachment
- Home
- Shed
- Roadway
- Railroad Tracks

ROW Wet Utility Encroachment
- Ag or Drainage Canal[4]
- Water Supply Pipeline
- Sewer Pipeline
- Natural Gas Pipeline
- Ag well
- Ag Turnout

ROW Dry Utility Encroachment
- Telephone Cable
- Overhead Utility[4]
- Fiber Optic Cable

Notes:

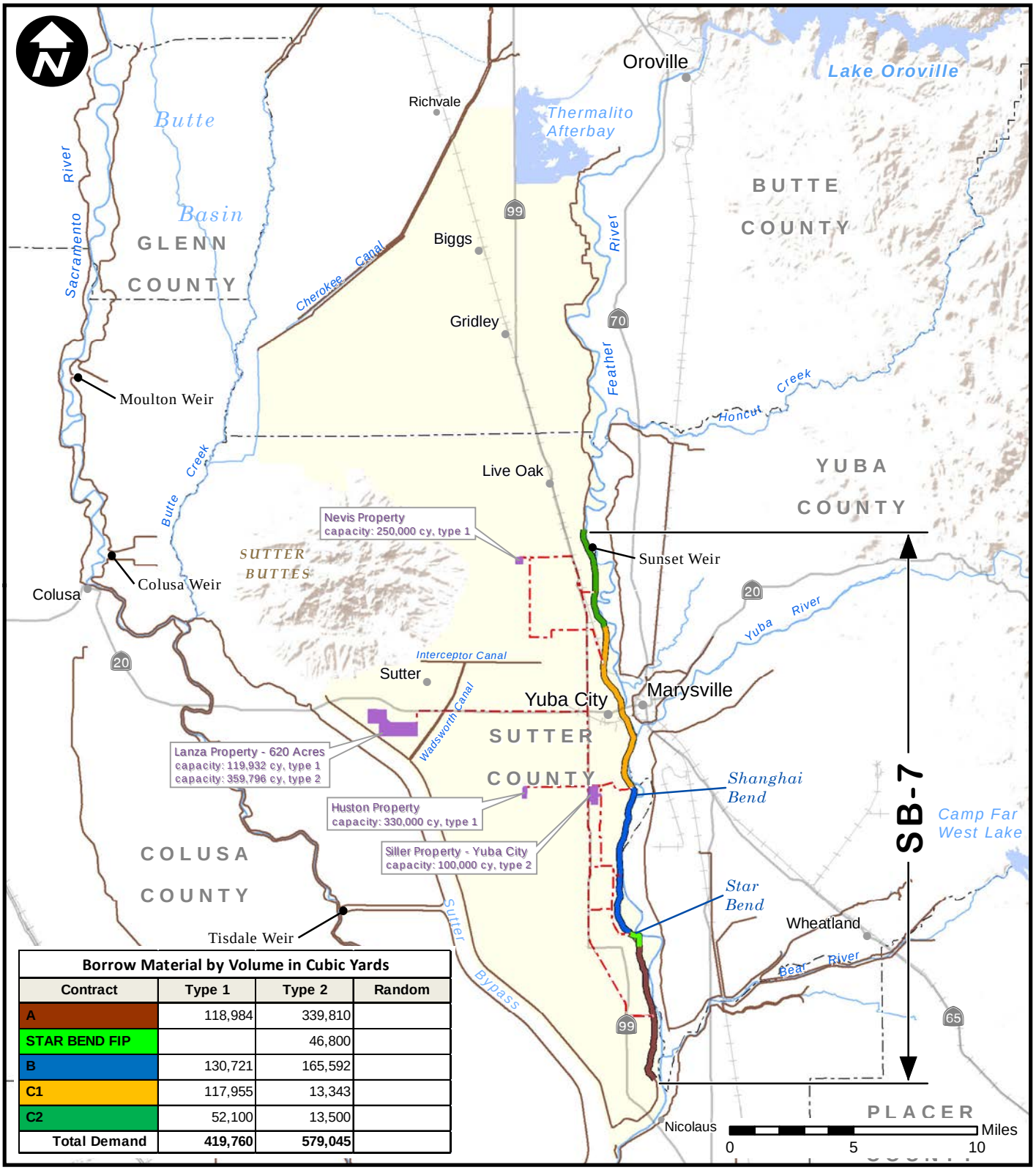
1. All utilities running parallel to the levee, unless located within the levee prism, are considered ROW Encroachments. All utilities running perpendicular to the levee are considered Levee Prism Encroachments, with the exception of overhead utilities, which are ONLY a levee prism encroachment if a supporting pole is located within the levee prism.

2. ROW Encroachments are those encroachments that fall within the limits of the Project ROW, 20 feet from landside levee toe, and 15 feet from waterside levee toe.

3. In general, levee prism structure and wet utility encroachments will be relocated or otherwise modified as part of the levee improvement contract. Levee prism dry utility encroachments will be addressed where expeditious or necessary to do so in advance of the levee improvement contract.

4. ROW wet or dry utility encroachments will be relocated prior to the levee improvement contract if they are deemed an impediment to construction access.

PLATE 2-6 UTILITY HANDLE CHART



Borrow Material by Volume in Cubic Yards

Contract	Type 1	Type 2	Random
A	118,984	339,810	
STAR BEND FIP		46,800	
B	130,721	165,592	
C1	117,955	13,343	
C2	52,100	13,500	
Total Demand	**419,760**	**579,045**	

Legend

- Borrow Site
- Haul Route
- Contract Extent
- Federal Levee
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX

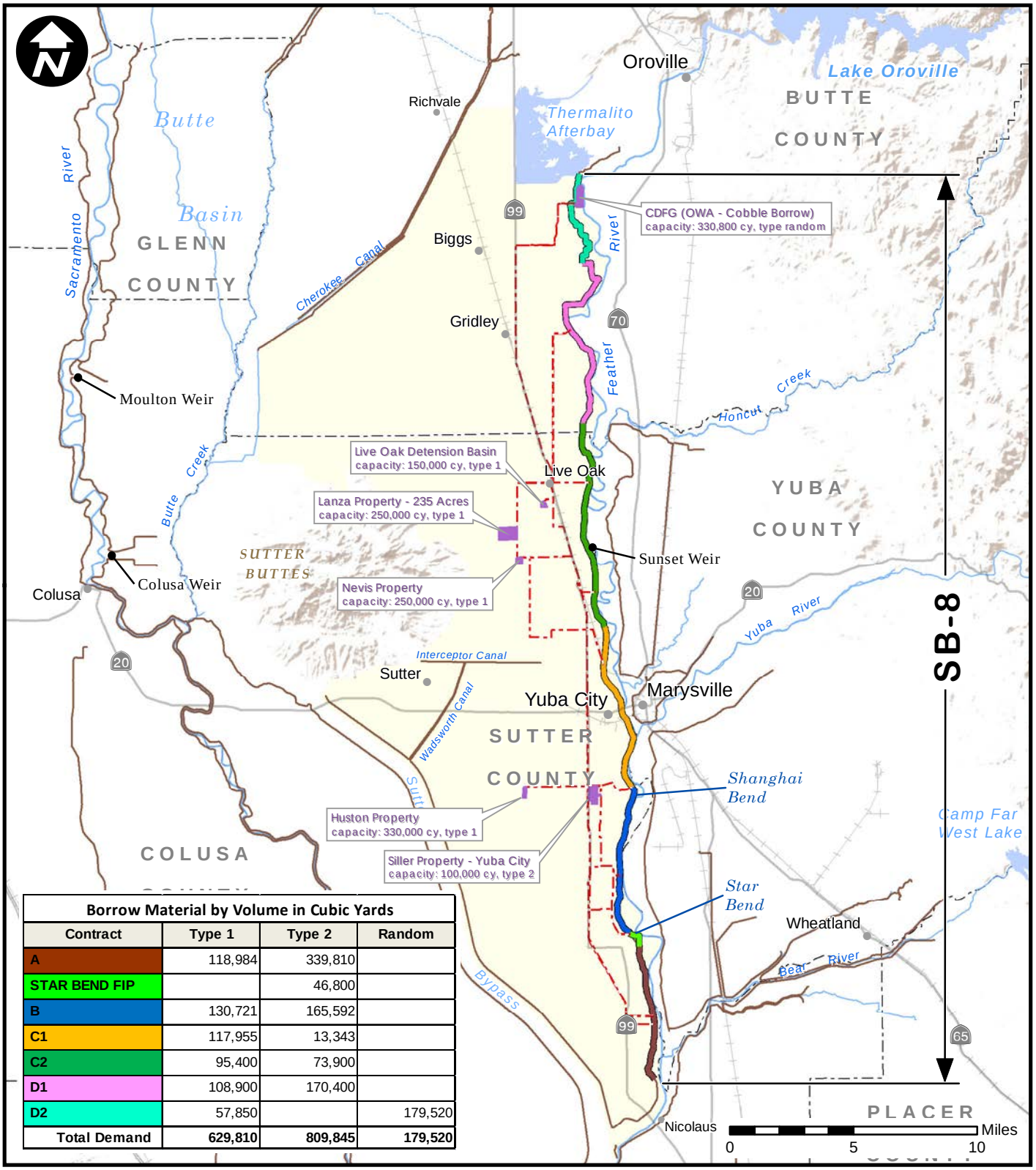
ALTERNATIVE SB-7: CONSTRUCTION CONTRACT BORROW SITES AND HAUL ROUTES

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by Jim Mars

APR 2013

PLATE 4-3



Borrow Material by Volume in Cubic Yards			
Contract	Type 1	Type 2	Random
A	118,984	339,810	
STAR BEND FIP		46,800	
B	130,721	165,592	
C1	117,955	13,343	
C2	95,400	73,900	
D1	108,900	170,400	
D2	57,850		179,520
Total Demand	**629,810**	**809,845**	**179,520**

Legend

- Borrow Site
- Haul Route
- Contract Extent
- Federal Levee
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX

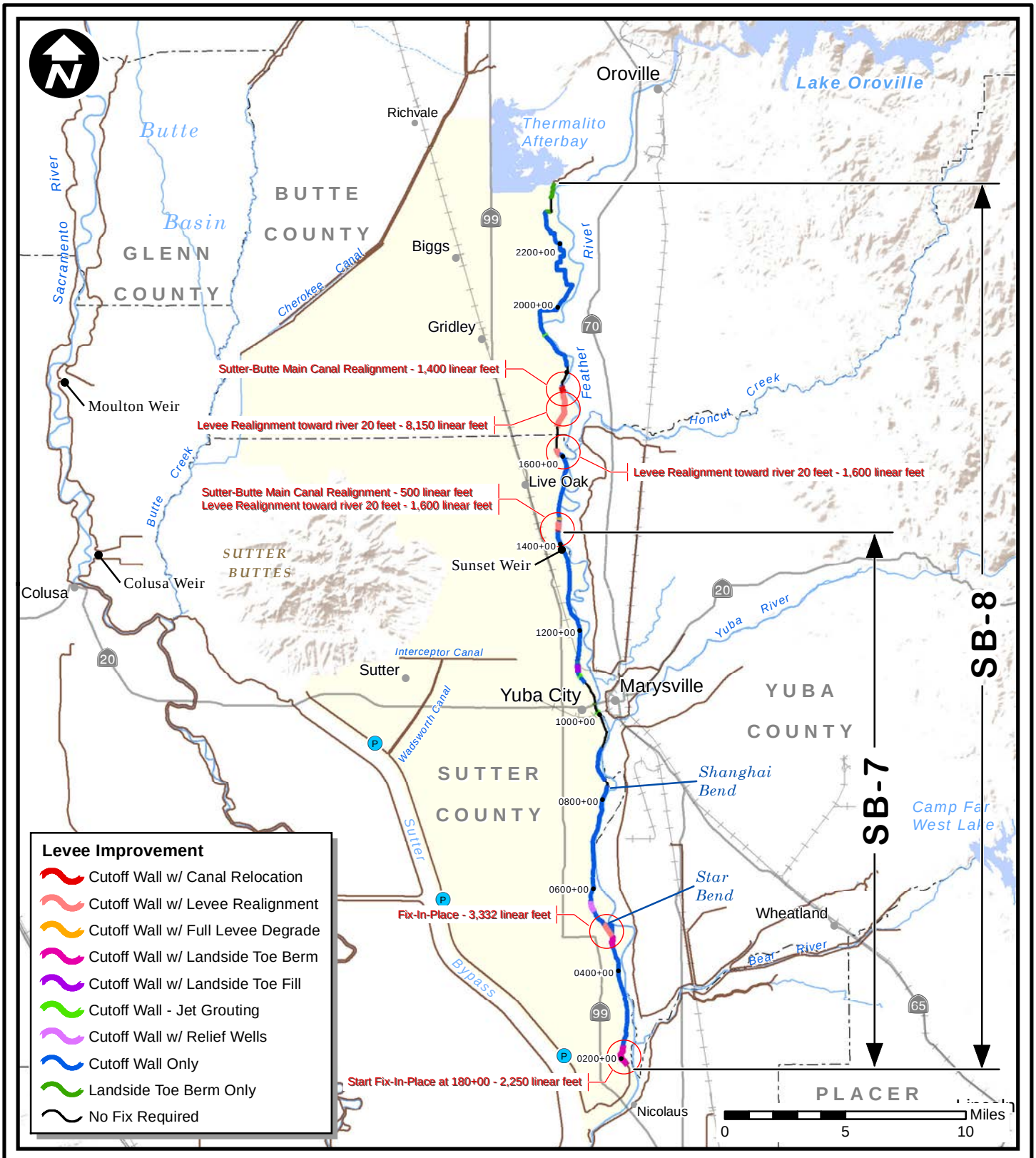
ALTERNATIVE SB-8: CONSTRUCTION CONTRACT BORROW SITES AND HAUL ROUTES

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by Jim Mars

APR 2013

PLATE 5-3



Legend

- Levee Improvement Site
- Study Area Extent
- Federal Levee
- Stationing Point
- Pump Station
- City or Town
- Lake or Reservoir
- River or Stream
- Highway
- Railroad
- County Boundary

SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX

LEVEE IMPROVEMENTS FOR FINAL ALTERNATIVES

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by Jim Mars

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PLATE G-1

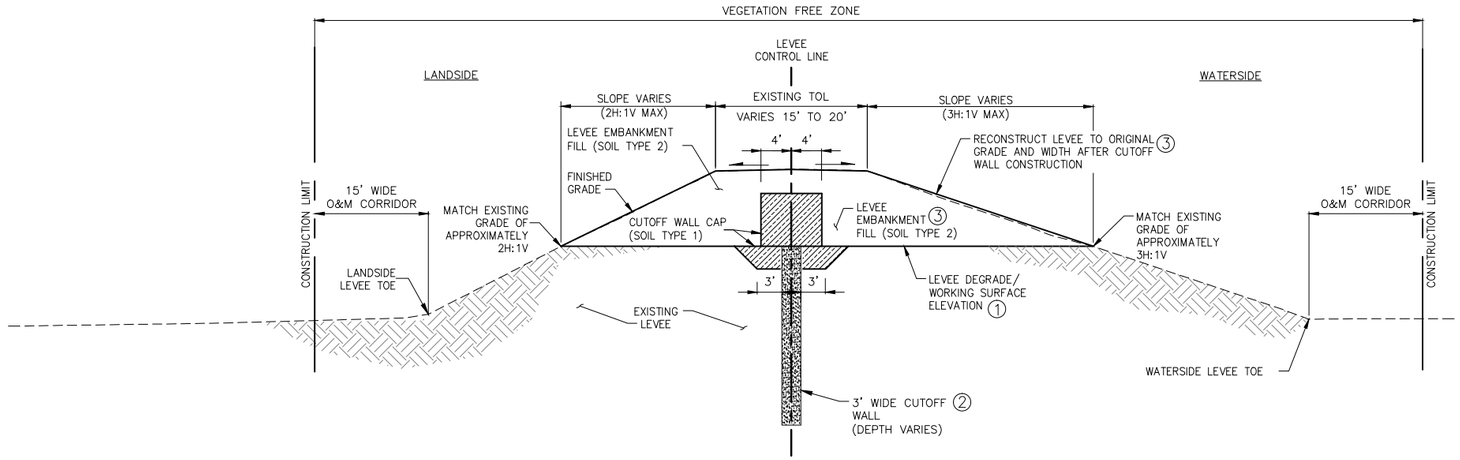

PLATE G-2A: TYPICAL CUTOFF WALL

SCALE: NONE

CONSTRUCTION SEQUENCE:

(1) DEGRADE EXISTING LEVEE.
(2) CONSTRUCT CUTOFF WALL.
(3) RECONSTRUCT LEVEE EMBANKMENT.

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Sacramento District

Symbol	Description	Date
DA	DESCRIPTION8	DATE8
D7	DESCRIPTION7	DATE7
D6	DESCRIPTION6	DATE6
D5	DESCRIPTION5	DATE5
D4	DESCRIPTION4	DATE4
D3	DESCRIPTION3	DATE3
D2	DESCRIPTION2	DATE2
D1	DESCRIPTION1	DATE1

Approved

Designed by: _
Dwn by: _
Reviewed by: _
Submitted by: _
CHIEF, CIV ENGR DES SEC A

Date: _
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File name: $$$$confirm$$$$
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SUTTER & BUTTE COUNTY CALIFORNIA
SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX
PLATE G-2A
TYPICAL LEVEE IMPROVEMENT-CUTOFF WALL

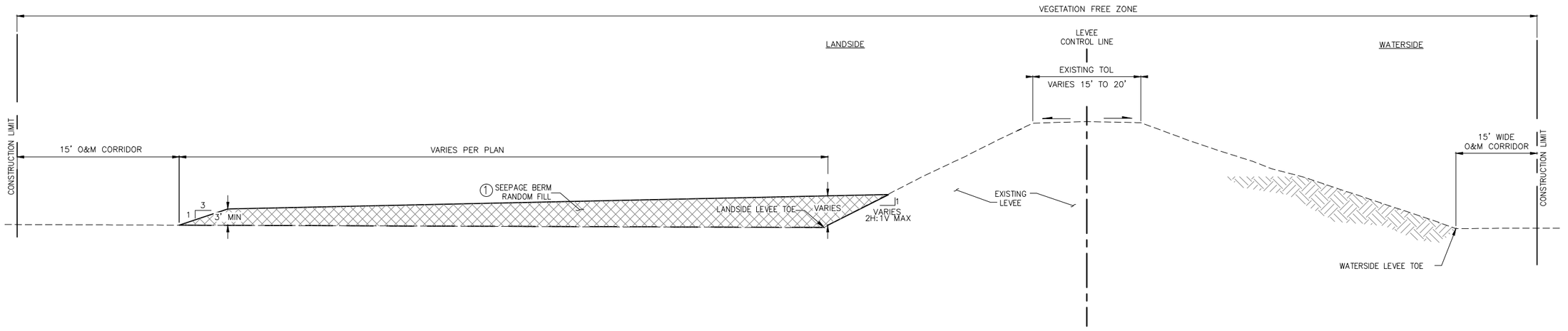

PLATE G2-B: TYPICAL SEEPAGE BERM

SCALE: NONE

CONSTRUCTION SEQUENCE:

(1) INSTALL RANDOM FILL FOR SEEPAGE BERM

US Army Corps of Engineers
Sacramento District

Symbol	Description	Date Approved
D8	DESCRIPTION8	DATE8APPROVAL
D7	DESCRIPTION7	DATE7APPROVAL
D6	DESCRIPTION6	DATE6APPROVAL
D5	DESCRIPTION5	DATE5APPROVAL
D4	DESCRIPTION4	DATE4APPROVAL
D3	DESCRIPTION3	DATE3APPROVAL
D2	DESCRIPTION2	DATE2APPROVAL
D1	DESCRIPTION1	DATE1APPROVAL

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Reviewed by: –
Submitted by: –
CHIEF, CIV ENGR DES SEC A

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SUTTER & BUTTE COUNTY CALIFORNIA
SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX
PLATE G-2B
TYPICAL LEVEE IMPROVEMENT - SEEPAGE BERM

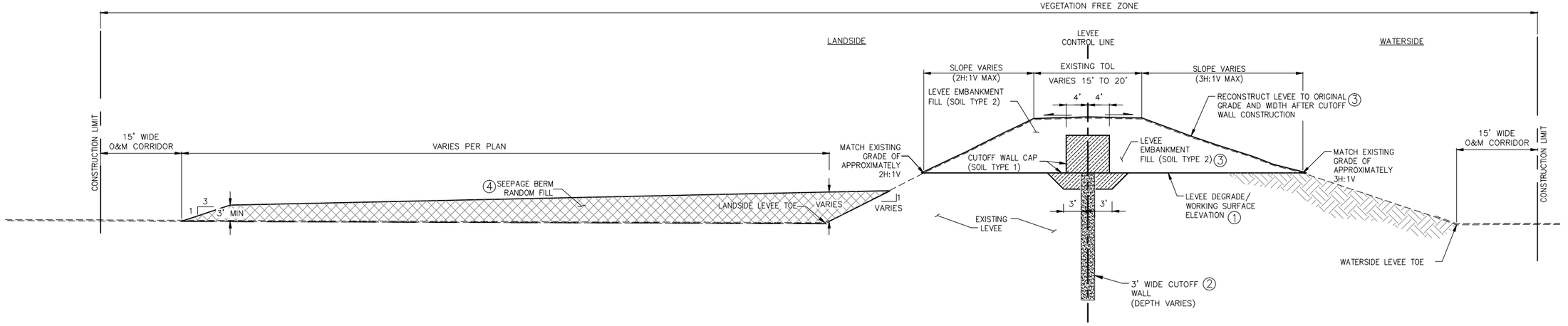

PLATE G-2C1: TYPICAL CUTOFF WALL WITH SEEPAGE BERM

SCALE: NONE

CONSTRUCTION SEQUENCE:

1. DEGRADE EXISTING LEVEE.
2. CONSTRUCT CUTOFF WALL.
3. RECONSTRUCT LEVEE EMBANKMENT.
4. INSTALL RANDOM FILL FOR SEEPAGE BERM

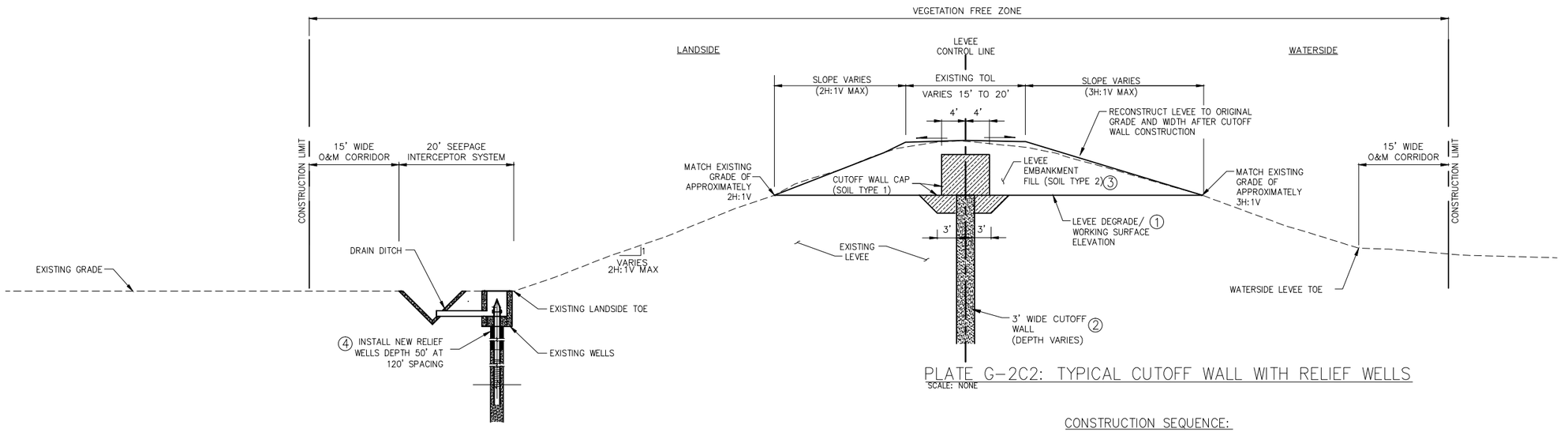

PLATE G-2C2: TYPICAL CUTOFF WALL WITH RELIEF WELLS

SCALE: NONE

CONSTRUCTION SEQUENCE:

1. DEGRADE EXISTING LEVEE.
2. CONSTRUCT CUTOFF WALL.
3. RECONSTRUCT LEVEE EMBANKMENT.
4. INSTALL ADDITIONAL RELIEF WELLS (WHERE APPLICABLE)

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DA	DESCRIPTION8	DATE8 APPROVAL
D7	DESCRIPTION7	DATE7 APPROVAL
D6	DESCRIPTION6	DATE6 APPROVAL
D5	DESCRIPTION5	DATE5 APPROVAL
D4	DESCRIPTION4	DATE4 APPROVAL
D3	DESCRIPTION3	DATE3 APPROVAL
D2	DESCRIPTION2	DATE2 APPROVAL
D1	DESCRIPTION1	DATE1 APPROVAL

Date: –
Rev: –
Designed by: –
Dwn by: –
Spec No.: –
Reviewed by: –
Drawing Code: –
File name: $$$$dwf$$$$
Plot date: $$$$
Plot scale: –
Submitted by: –
Chief, CIV DIV, DES SEC A

DEPARTMENT OF THE ARMY
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SUTTER & BUTTE COUNTY CALIFORNIA
SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX
PLATE G-2C

TYPICAL LEVEE IMPROVEMENT – CUTOFF WALL WITH SEEPAGE BERM OR RELIEF WELLS

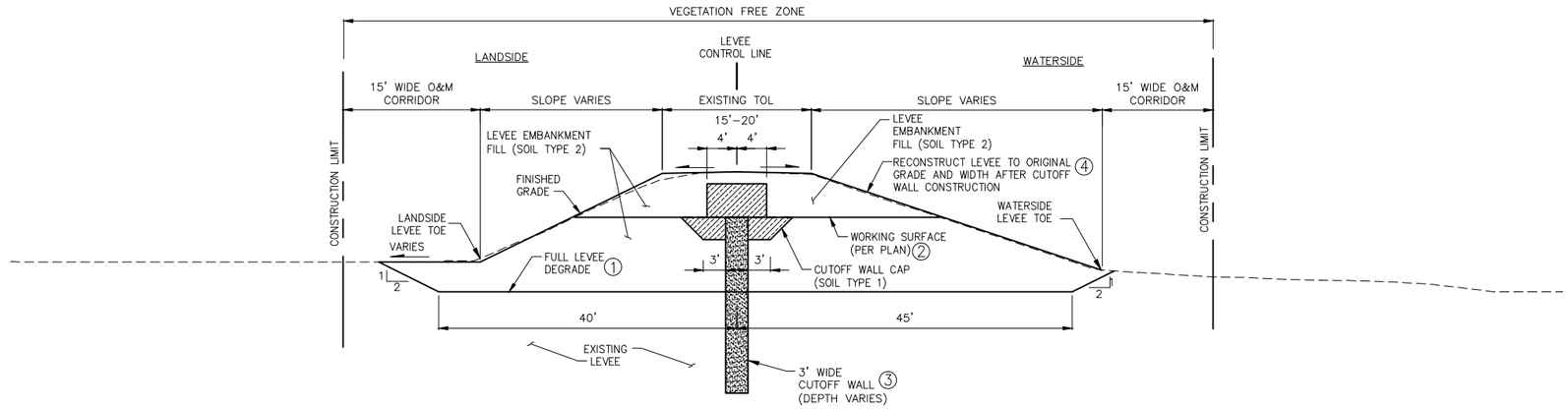

PLATE G-2D1: TYPICAL CUTOFF WALL WITH FULL LEVEE DEGRADE

SCALE: NONE

CONSTRUCTION SEQUENCE:

(1) DEGRADE EXISTING LEVEE.
(2) FILL UP TO WORKING SURFACE ELEVATION
(3) CONSTRUCT CUTOFF WALL.
(4) RECONSTRUCT LEVEE EMBANKMENT.

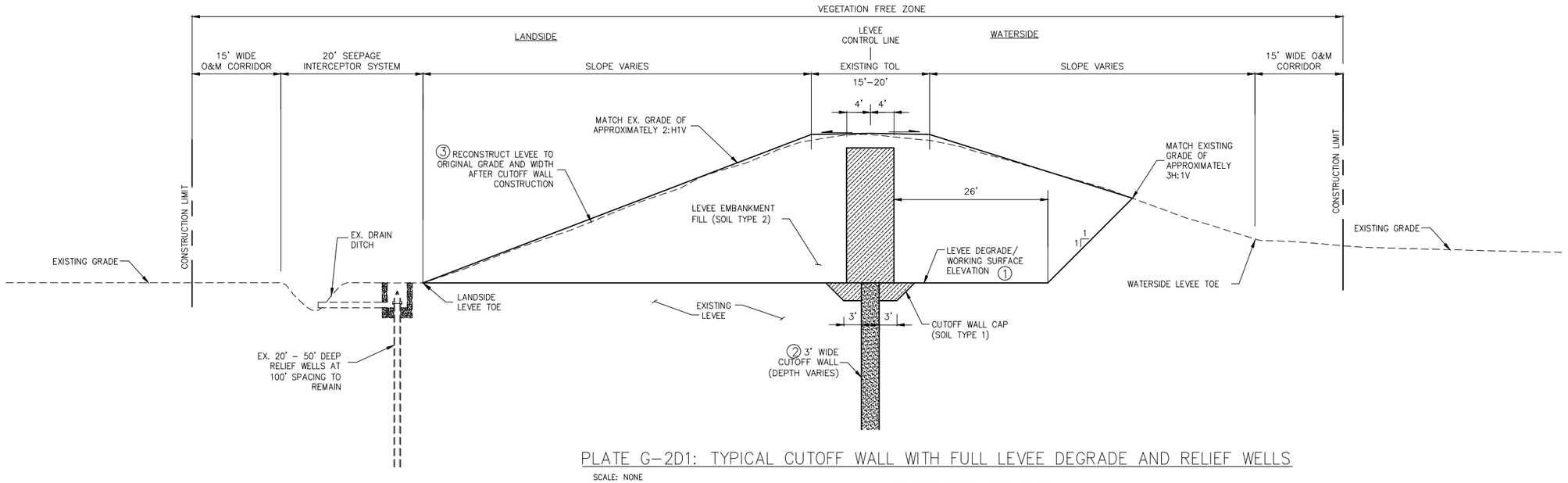

PLATE G-2D1: TYPICAL CUTOFF WALL WITH FULL LEVEE DEGRADE AND RELIEF WELLS

SCALE: NONE

CONSTRUCTION SEQUENCE:

(1) DEGRADE EXISTING LEVEE.
(2) CONSTRUCT CUTOFF WALL.
(3) RECONSTRUCT LEVEE EMBANKMENT.

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Symbol	Description	Date Approved
DA	DESCRIPTION8	DATE8 APPROVAL
DA	DESCRIPTION7	DATE7 APPROVAL
DA	DESCRIPTION6	DATE6 APPROVAL
DA	DESCRIPTION5	DATE5 APPROVAL
DA	DESCRIPTION4	DATE4 APPROVAL
DA	DESCRIPTION3	DATE3 APPROVAL
DA	DESCRIPTION2	DATE2 APPROVAL
DA	DESCRIPTION1	DATE1 APPROVAL

Designed by: –
Dwn by: –
Date: –
Spec No.: –
Reviewed by: –
Drawing Code: –
Submitted by: –
CHIEF, CIV ENGR DES SEC A
Rev. –
Design file no: –
File name: $$$$confSS
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SUTTER & BUTTE COUNTY CALIFORNIA
SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX
PLATE G-2D

TYPICAL LEVEE IMPROVEMENT – CUTOFF WALL WITH FULL LEVEE DEGRADE AND RELIEF WELLS

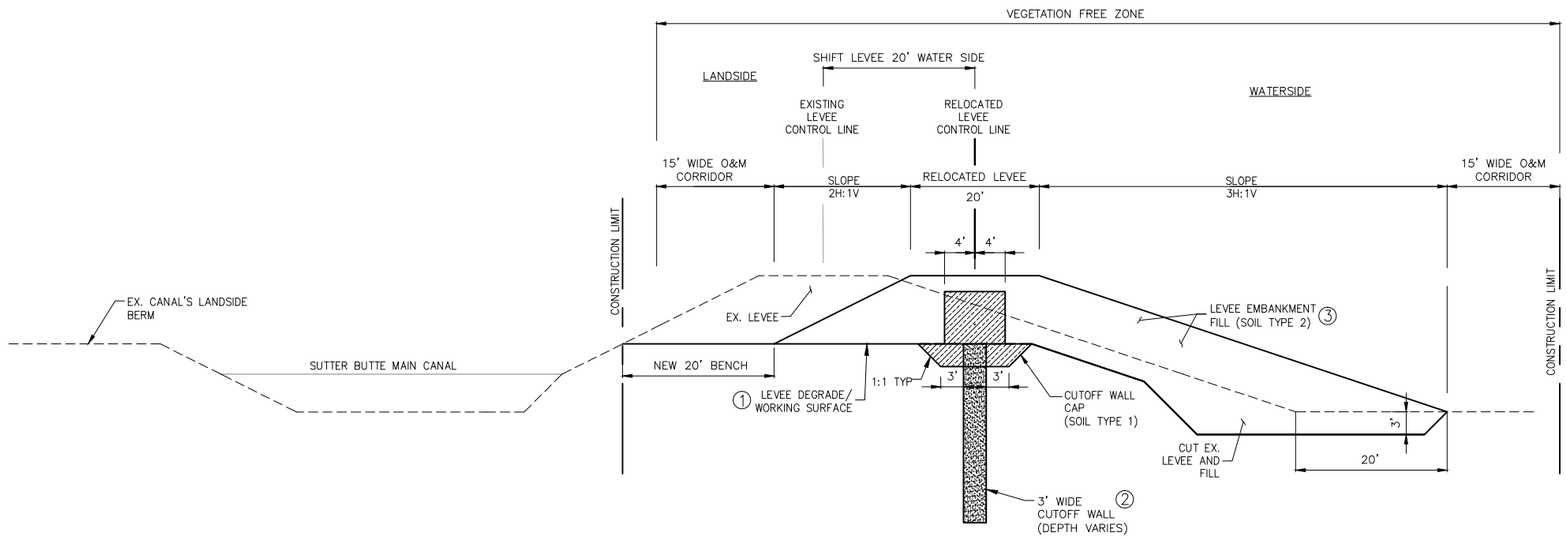

PLATE G-2E: TYPICAL CUTOFF WALL WITH LEVEE RELOCATION

SCALE: NONE

CONSTRUCTION SEQUENCE:

1. DEGRADE EXISTING LEVEE.
2. CONSTRUCT CUTOFF WALL.
3. CONSTRUCT RELOCATED LEVEE EMBANKMENT.

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Symbol	Description	Date Approved
DA	DESCRIPTION8	DATE8APPROVAL
D7	DESCRIPTION7	DATE7APPROVAL
D6	DESCRIPTION6	DATE6APPROVAL
D5	DESCRIPTION5	DATE5APPROVAL
D4	DESCRIPTION4	DATE4APPROVAL
D3	DESCRIPTION3	DATE3APPROVAL
D2	DESCRIPTION2	DATE2APPROVAL
D1	DESCRIPTION1	DATE1APPROVAL

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Dwn by: –
Reviewed by: –
Submitted by: –
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Date: –
Design file no: –
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ENGINEERING APPENDIX
PLATE G-2E
TYPICAL LEVEE IMPROVEMENT – CUTOFF WALL WITH LEVEE RELOCATION

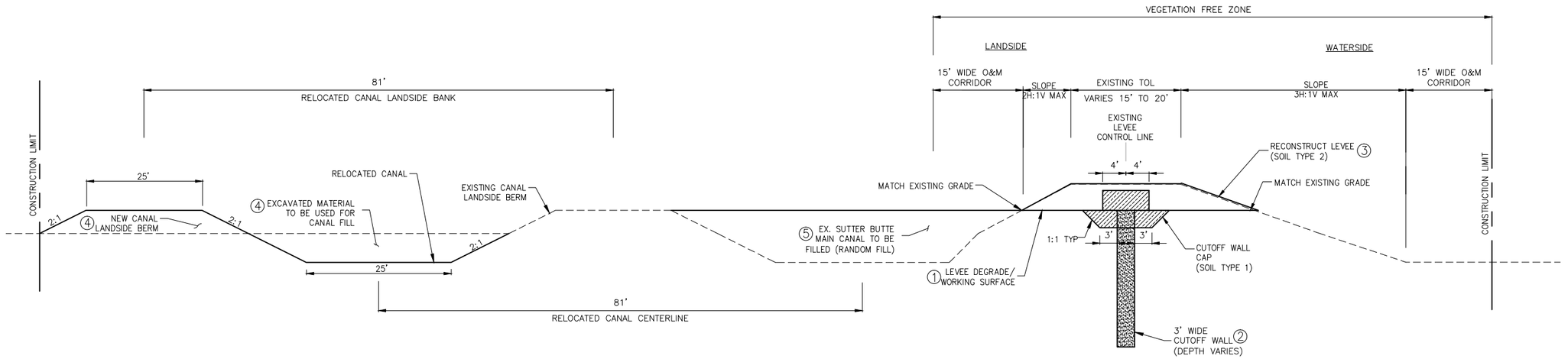

PLATE G-2F: TYPICAL CUTOFF WALL WITH CANAL RELOCATION

SCALE: NONE

CONSTRUCTION SEQUENCE:

1. DEGRADE EXISTING LEVEE.
2. CONSTRUCT CUTOFF WALL.
3. RECONSTRUCT LEVEE EMBANKMENT.
4. EXCAVATE NEW SUTTER BUTTE CANAL AND CONSTRUCT NEW CANAL LANDSIDE BERM.
5. FILL SUTTER BUTTE CANAL WITH EXCAVATED MATERIAL

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D5	DESCRIPTION5	DATE5APPROVAL
D4	DESCRIPTION4	DATE4APPROVAL
D3	DESCRIPTION3	DATE3APPROVAL
D2	DESCRIPTION2	DATE2APPROVAL
D1	DESCRIPTION1	DATE1APPROVAL

Date: –
Rev.: –
Design file no.: –
Spec No.: –
Drawing Code: –
File name: $$$$confSS
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Plot scale: –
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ENGINEERING APPENDIX
PLATE G-2F
TYPICAL LEVEE IMPROVEMENT – CUTOFF WALL WITH CANAL RELOCATION

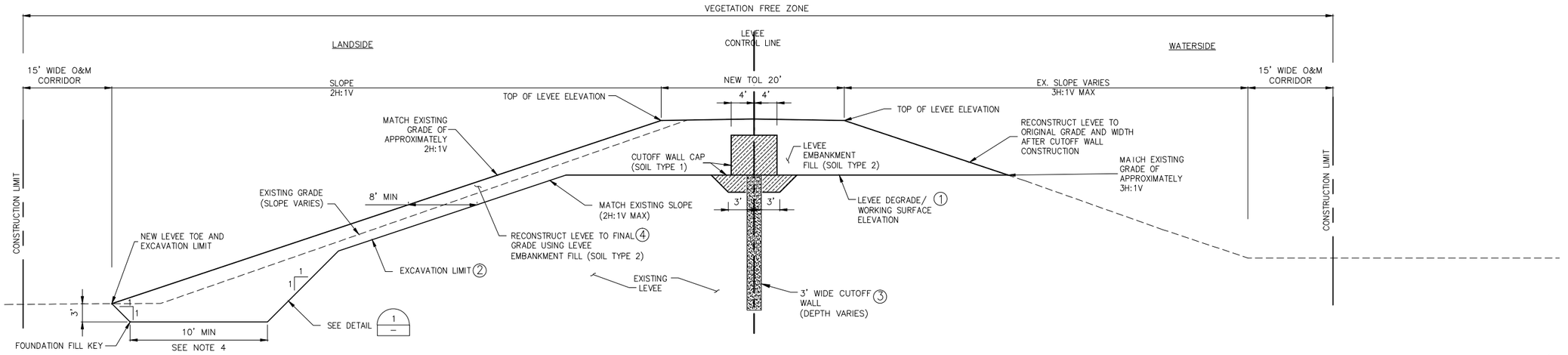
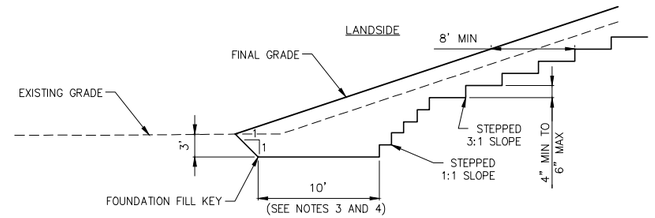


PLATE G-2G: TYPICAL CUTOFF WALL WITH LANDSIDE TOE FILL

SCALE: NONE

CONSTRUCTION SEQUENCE:

1. DEGRADE EXISTING LEVEE.
2. EXCAVATE LANDSIDE OF EXISTING LEVEE.
3. CONSTRUCT CUTOFF WALL.
4. RECONSTRUCT LEVEE EMBANKMENT.



1 — FILL KEY AND BENCHING DETAIL

NTS

TYPICAL KEY & BENCHING NOTES:

1. PLACE FILL IN HORIZONTAL LIFTS AGAINST VERTICAL FACES CUT INTO EXISTING LEVEE MATERIAL.
2. THE BOTTOM OF THE KEY TRENCH SHALL BE SCARIFIED TO A DEPTH OF 8 INCHES AND RECOMPACTED TO 95% MAXIMUM DENSITY PER ASTM D698.
3. THE LEVEE KEY TRENCH SHALL BE INSPECTED BY THE AGENCY'S GEOTECHNICAL ENGINEER BEFORE PLACEMENT OF FILL.
4. WHERE EMBANKMENT FILL IS GREATER THAN 10' IN WIDTH, FOUNDATION KEY SHALL EXTEND FROM THE TOE OF THE NEW LEVEE TO THE TOE OF THE EXISTING LEVEE. IN NO CASE SHALL THE FOUNDATION KEY WIDTH BE LESS THAN 10'.

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D6	DESCRIPTION6	DATE6APPROVAL
D5	DESCRIPTION5	DATE5APPROVAL
D4	DESCRIPTION4	DATE4APPROVAL
D3	DESCRIPTION3	DATE3APPROVAL
D2	DESCRIPTION2	DATE2APPROVAL
D1	DESCRIPTION1	DATE1APPROVAL

Designed by: –
Dwn by: –
Spec No.: –
Reviewed by: –
Submitted by: –
Date: –
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Drawing Code: –
File name: $$$$confSS
Plot date: –
Plot scale: –
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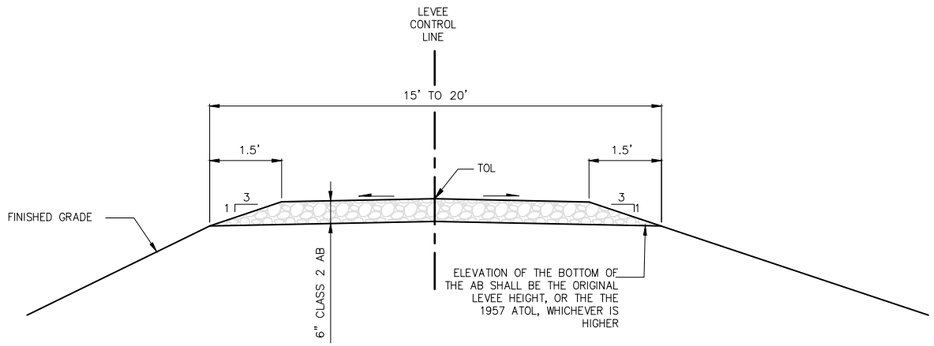
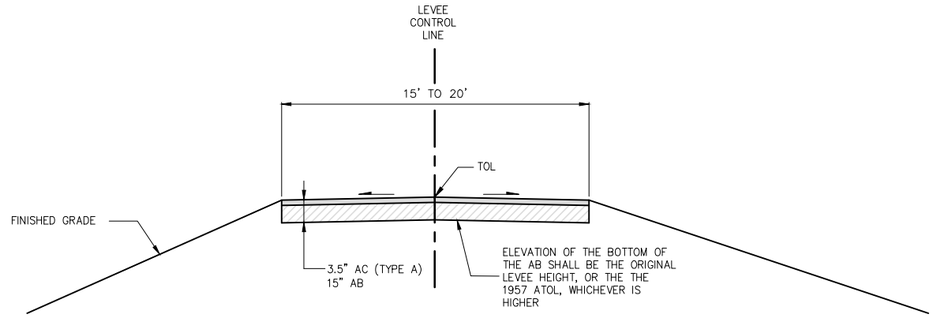
PLATE G-2G
TYPICAL LEVEE IMPROVEMENT – TYPICAL CUTOFF WALL WITH LANDSIDE TOE FILL



CROWN SURFACING DETAIL (TYP)

NTS



PAVED LEVEE ROAD SECTION

NTS

PLATE G-2H: TYPICAL LEVEE ROAD DETAIL

NTS

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D8	DESCRIPTION8	DATE8APPROVAL
D7	DESCRIPTION7	DATE7APPROVAL
D6	DESCRIPTION6	DATE6APPROVAL
D5	DESCRIPTION5	DATE5APPROVAL
D4	DESCRIPTION4	DATE4APPROVAL
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D2	DESCRIPTION2	DATE2APPROVAL
D1	DESCRIPTION1	DATE1APPROVAL

Date: –
Design file no: –
Drawing Code: –
File name: $$$$confSS
Plot date: $$$$confSS
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PLATE G-2H
TYPICAL LEVEE IMPROVEMENT - TYPICAL LEVEE ROAD DETAIL

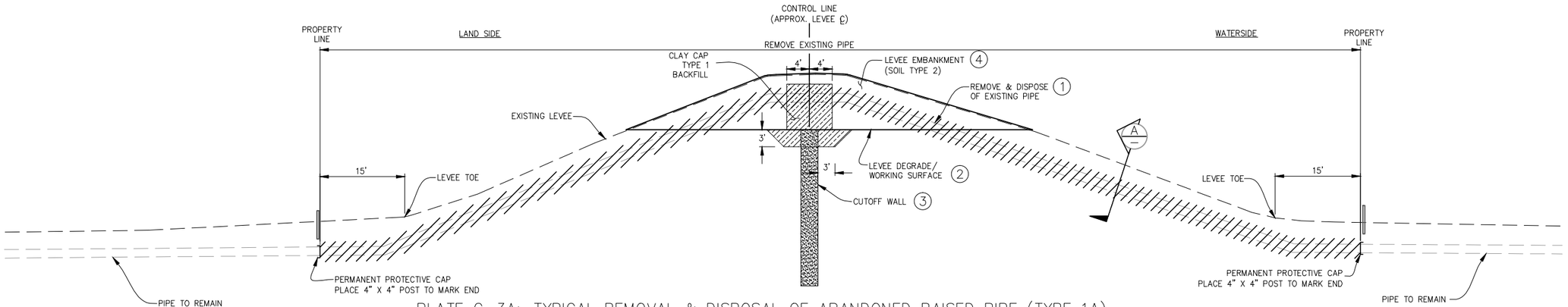
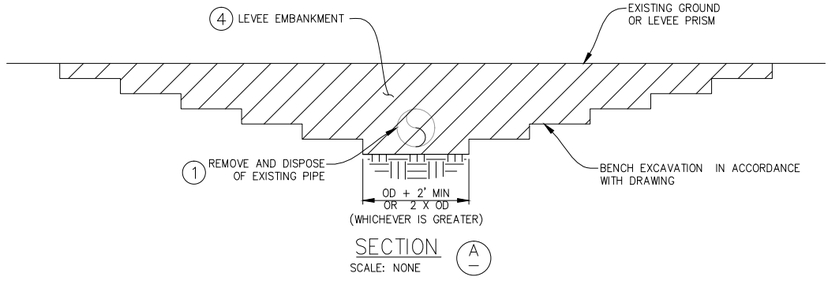


PLATE G-3A: TYPICAL REMOVAL & DISPOSAL OF ABANDONED RAISED PIPE (TYPE 1A)

SCALE: NONE

CONSTRUCTION SEQUENCE:

1. EXCAVATE, REMOVE AND DISPOSE OF EXISTING PIPE OFFSITE, AND BACKFILL UP TO WORKING SURFACE.
2. DEGRADE EXISTING LEVEE.
3. CONSTRUCT CUTOFF WALL.
4. RECONSTRUCT LEVEE EMBANKMENT.



SECTION A/1

SCALE: NONE

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D1	DESCRIPTION1	DATE1APPROVAL

Date: –
Design file no: –
Drawing Code: –
File name: $$$$conf$$$$
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PLATE G-3A
TYPICAL UTILITY IMPROVEMENT - REMOVAL AND DISPOSAL OF ABANDONED RAISED PIPE

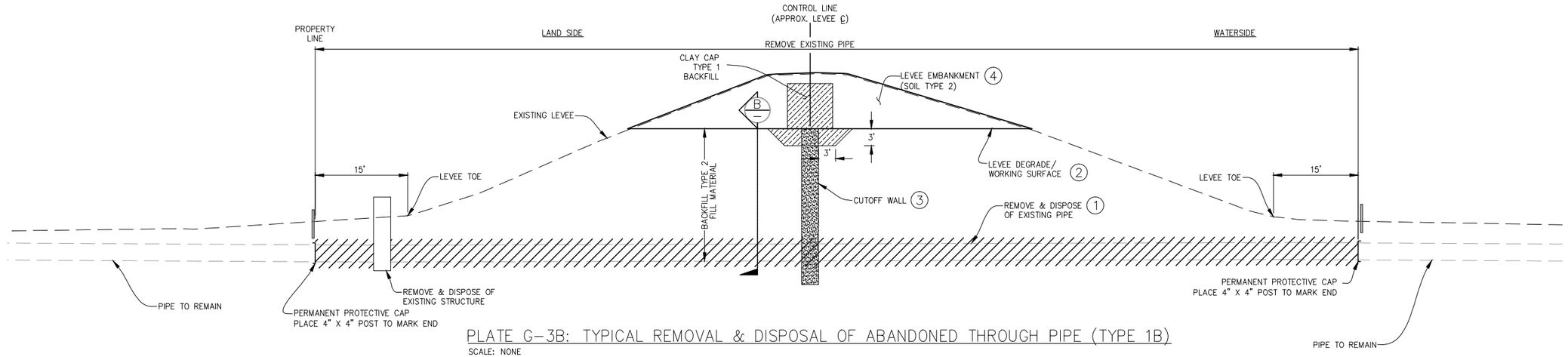
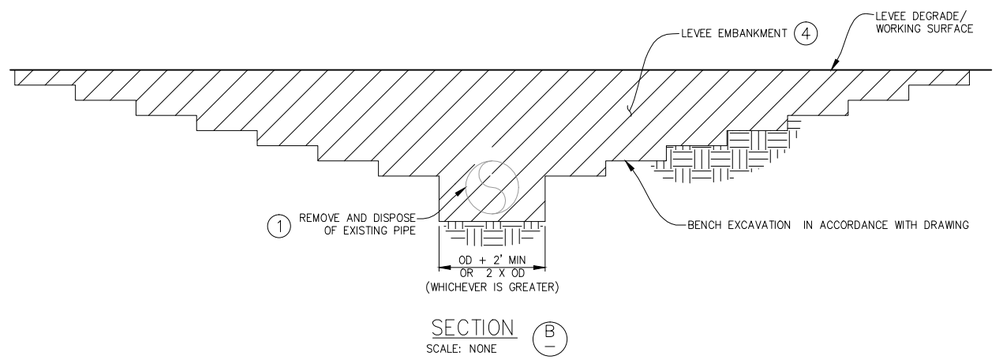


PLATE G-3B: TYPICAL REMOVAL & DISPOSAL OF ABANDONED THROUGH PIPE (TYPE 1B)

SCALE: NONE

CONSTRUCTION SEQUENCE:

1. EXCAVATE, REMOVE AND DISPOSE OF EXISTING PIPE OFFSITE, AND BACKFILL UP TO WORKING SURFACE.
2. DEGRADE EXISTING LEVEE.
3. CONSTRUCT CUTOFF WALL.
4. RECONSTRUCT LEVEE EMBANKMENT.



SECTION (B/—)

SCALE: NONE

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D1	DESCRIPTION1	DATE1APPROVAL

Date: —
Design file no: —
Drawing Code: —
File name: $$$$conf$$$$
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PLATE G-3B
TYPICAL UTILITY IMPROVEMENT — REMOVAL AND DISPOSAL OF ABANDONED THROUGH PIPE

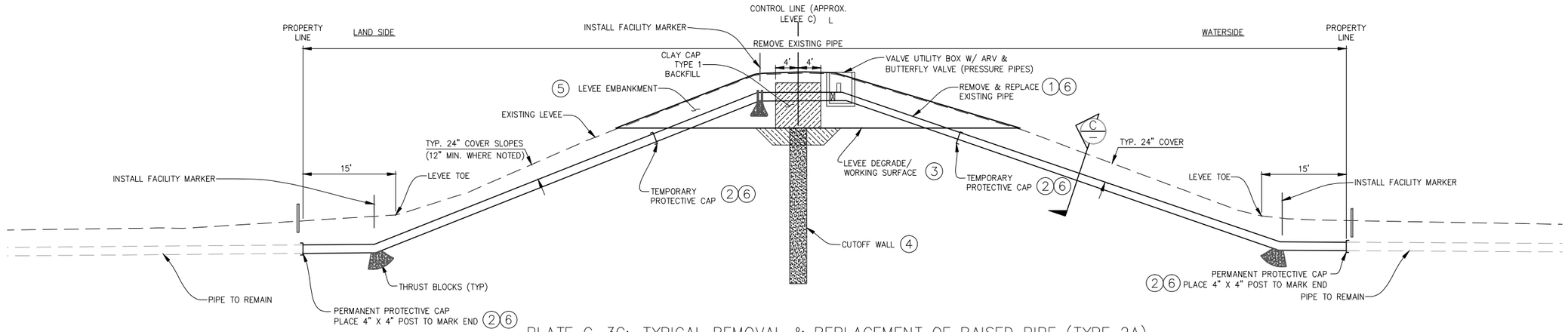


PLATE G-3C: TYPICAL REMOVAL & REPLACEMENT OF RAISED PIPE (TYPE 2A)

SCALE: NONE

CONSTRUCTION SEQUENCE:

(1) EXCAVATE, REMOVE AND DISPOSE OF EXISTING PIPE OFFSITE, AND BACKFILL UP TO DEGRADE / WORKING SURFACE.

(2) PROVIDE CAP AND MARKER AT THE END OF THE EXISTING PIPE WITH PROPER THRUST BLOCK OR RESTRAINED JOINT FOR PRESSURIZED PIPES.

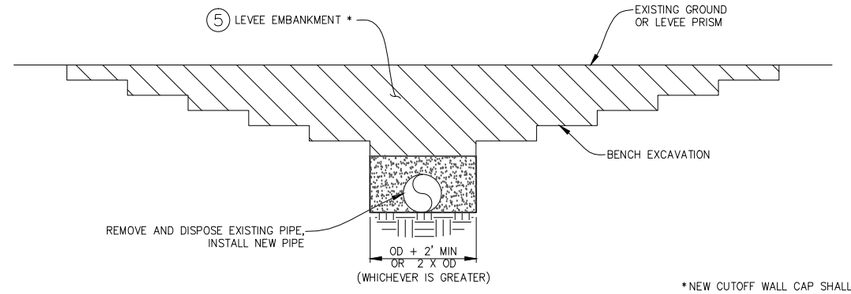
(3) DEGRADE EXISTING LEVEE.

(4) CONSTRUCT CUTOFF WALL.

(5) RECONSTRUCT LEVEE EMBANKMENT.

(6) EXCAVATE, INSTALL NEW PIPE, CONNECT TO EXISTING PIPE, INSTALL MARKER AND BACKFILL

NOTE: THE BOTTOM OF THE NEW PIPE SHALL BE ABOVE THE FREEBOARD ELEVATION AT THE LEVEE CROWN



SECTION (C)

SCALE: NONE

*NEW CUTOFF WALL CAP SHALL BE INSTALLED, WHERE EXCAVATED, FOUR (4) FEET BOTH SIDES FOR WALL.

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D6	DESCRIPTION6	DATE6APPROVAL
D5	DESCRIPTION5	DATE5APPROVAL
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D1	DESCRIPTION1	DATE1APPROVAL

Date: –
Design file no: –
Drawing Code: –
File name: $$$$confSS
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Spec No.: –
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PLATE G-3C
TYPICAL UTILITY IMPROVEMENT – REMOVAL AND REPLACEMENT OF RAISED PIPE

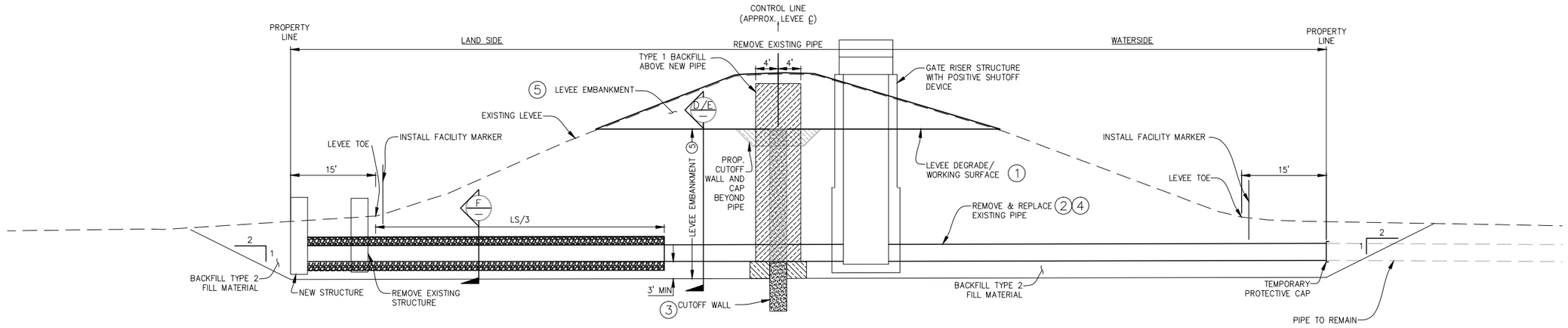
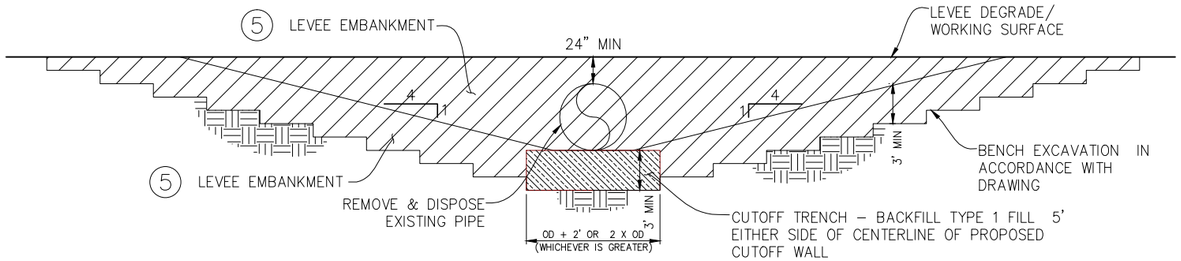


PLATE G–3D: TYPICAL REMOVAL & REPLACEMENT OF THROUGH PIPE (TYPE 2B)

SCALE: NONE

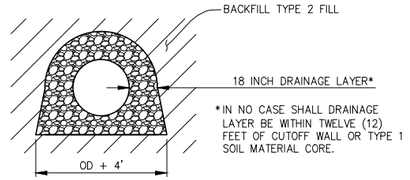
CONSTRUCTION SEQUENCE:

1. DEGRADE EXISTING LEVEE.
2. EXCAVATE, REMOVE AND DISPOSE OF EXISTING PIPE OFFSITE, AND BACKFILL UP TO WORKING SURFACE (SEE SECTION D).
3. CONSTRUCT CUTOFF WALL.
4. EXCAVATE, INSTALL NEW PIPE AND BACKFILL UP TO WORKING SURFACE (SEE SECTION E).
5. RECONSTRUCT LEVEE EMBANKMENT FOR AREA EXCAVATED FOR PIPE AN RISER INSTALLATION.



SECTION (D)

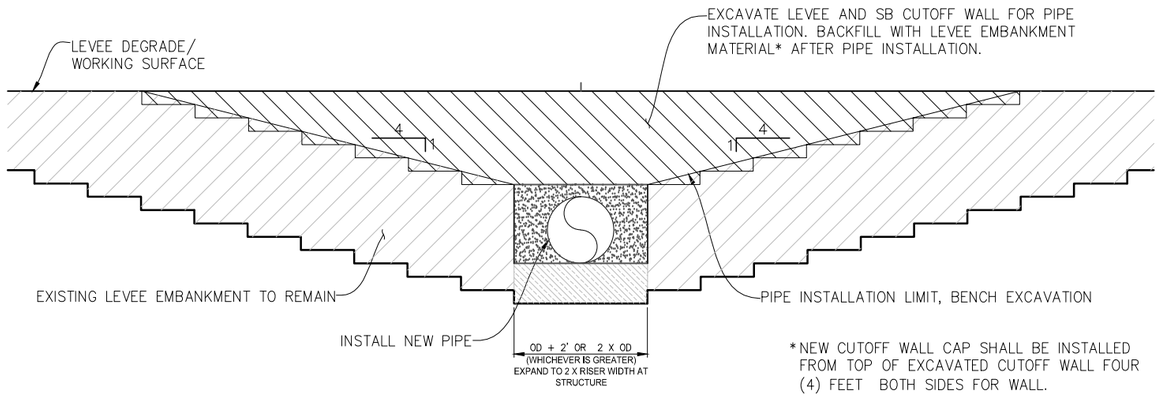
SCALE: NONE



*IN NO CASE SHALL DRAINAGE LAYER BE WITHIN TWELVE (12) FEET OF CUTOFF WALL OR TYPE 1 SOIL MATERIAL CORE.

SECTION (F)

SCALE: NONE



*NEW CUTOFF WALL CAP SHALL BE INSTALLED FROM TOP OF EXCAVATED CUTOFF WALL FOUR (4) FEET BOTH SIDES FOR WALL.

SECTION (E)

SCALE: NONE

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D6	DESCRIPTION6	DATE6APPROVAL
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D1	DESCRIPTION1	DATE1APPROVAL

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Drawn by: –
Reviewed by: –
Submitted by: –
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Drawing Code: –
File name: $$$$conf$$$$
Plot date: –
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PLATE G–3D
TYPICAL UTILITY IMPROVEMENT – REMOVAL AND REPLACEMENT OF THROUGH PIPE

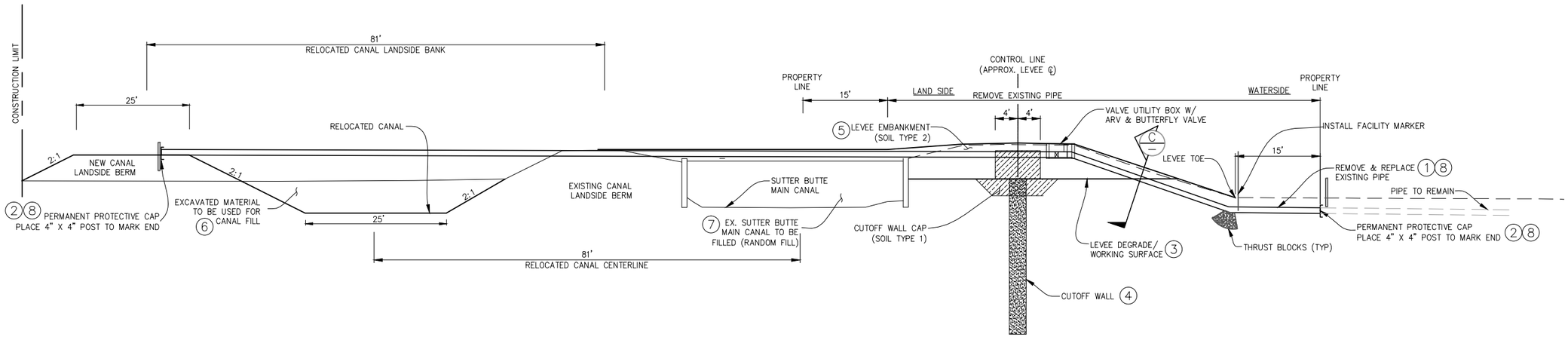
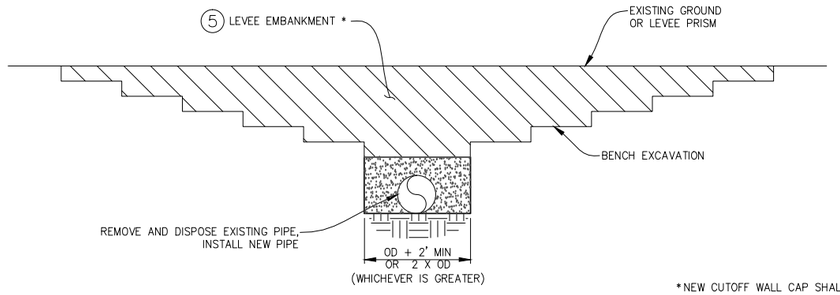


PLATE G-3E1: TYPICAL REMOVAL & REPLACEMENT OF RAISED PIPE WITH CANAL RELOCATION (TYPE 3A1)

SCALE: NONE

CONSTRUCTION SEQUENCE:

1. EXCAVATE, REMOVE AND DISPOSE OF EXISTING PIPE OFFSITE, AND BACKFILL UP TO DEGRADE / WORKING SURFACE.
2. PROVIDE CAP AND MARKER AT THE END OF THE EXISTING PIPE WITH PROPER THRUST BLOCK OR RESTRAINED JOINT FOR PRESSURIZED PIPES.
3. DEGRADE EXISTING LEVEE.
4. CONSTRUCT CUTOFF WALL.
5. RECONSTRUCT LEVEE EMBANKMENT.
6. EXCAVATE NEW SUTTER BUTTE CANAL AND CONSTRUCT NEW LANDSIDE BERM
7. FILL SUTTER BUTTE CANAL WITH EXCAVATED MATERIAL
8. EXCAVATE, INSTALL NEW PIPE, CONNECT TO EXISTING PIPE, INSTALL MARKER AND BACKFILL



SECTION (C)

SCALE: NONE

*NEW CUTOFF WALL CAP SHALL BE INSTALLED, WHERE EXCAVATED, FOUR (4) FEET BOTH SIDES FOR WALL.

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D7	DESCRIPTION7	DATE7	APPROVAL7
D6	DESCRIPTION6	DATE6	APPROVAL6
D5	DESCRIPTION5	DATE5	APPROVAL5
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D3	DESCRIPTION3	DATE3	APPROVAL3
D2	DESCRIPTION2	DATE2	APPROVAL2
D1	DESCRIPTION1	DATE1	APPROVAL1

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Dwn by: –
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Spec No.: –
Design file no: –
Drawing Code: –
File name: $$$$dwf$$$$
Plot date: –
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PLATE G-3E1
TYPICAL UTILITY IMPROVEMENT – REMOVAL AND REPLACEMENT OF RAISED PIPE W/ CANAL RELOCATION

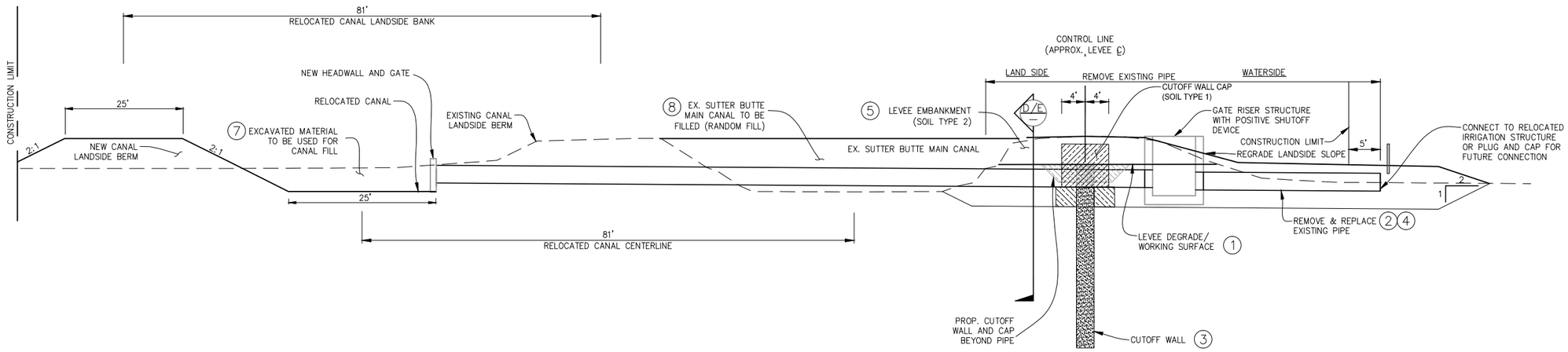
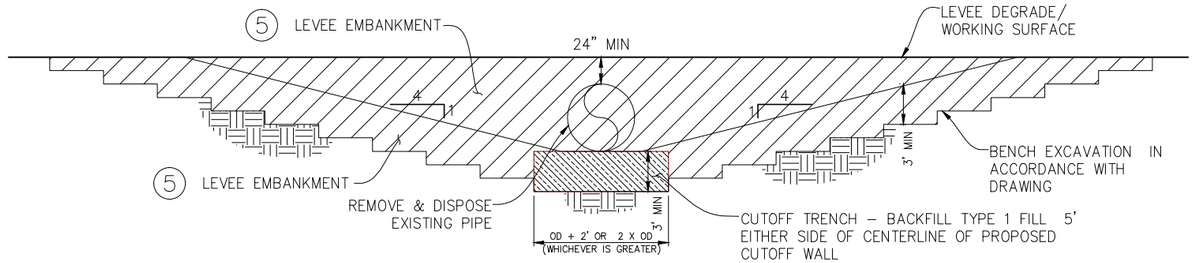


PLATE G-3E2: TYPICAL REMOVAL & REPLACEMENT OF THROUGH PIPE WITH CANAL RELOCATION (TYPE 3A2)

SCALE: NONE

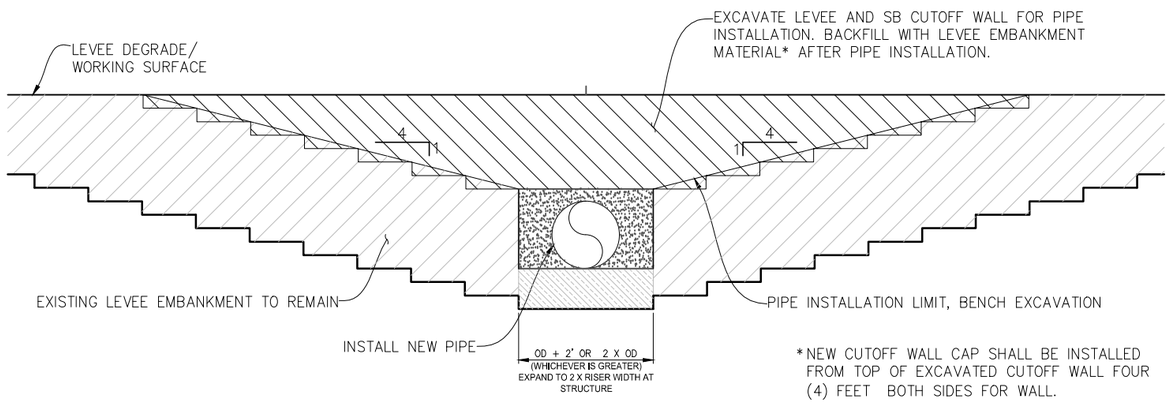
CONSTRUCTION SEQUENCE:

1. DEGRADE EXISTING LEVEE.
2. EXCAVATE, REMOVE AND DISPOSE OF EXISTING PIPE OFFSITE, AND BACKFILL UP TO WORKING SURFACE.
3. CONSTRUCT CUTOFF WALL.
4. EXCAVATE, INSTALL NEW PIPE AND BACKFILL UP TO WORKING SURFACE.
5. RECONSTRUCT LEVEE EMBANKMENT FOR AREA EXCAVATED FOR PIPE AND RISER INSTALLATION.
6. EXCAVATE NEW SUTTER BUTTE CANAL AND CONSTRUCT LANDSIDE BERM
7. BACKFILL OLD SUTTER BUTTE CANAL



SECTION D

SCALE: NONE



*NEW CUTOFF WALL CAP SHALL BE INSTALLED FROM TOP OF EXCAVATED CUTOFF WALL FOUR (4) FEET BOTH SIDES FOR WALL.

SECTION E

SCALE: NONE

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Symbol	Description	Date	Approved
D8	DESCRIPTION8	DATE8	APPROVAL8
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D2	DESCRIPTION2	DATE2	APPROVAL2
D1	DESCRIPTION1	DATE1	APPROVAL1

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Dwn by: –	Design file no: –	Spec No.: –	
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ENGINEERING APPENDIX
PLATE G-3E2
TYPICAL UTILITY IMPROVEMENT – REMOVAL AND REPLACEMENT OF THROUGH PIPE W/ CANAL RELOCATION

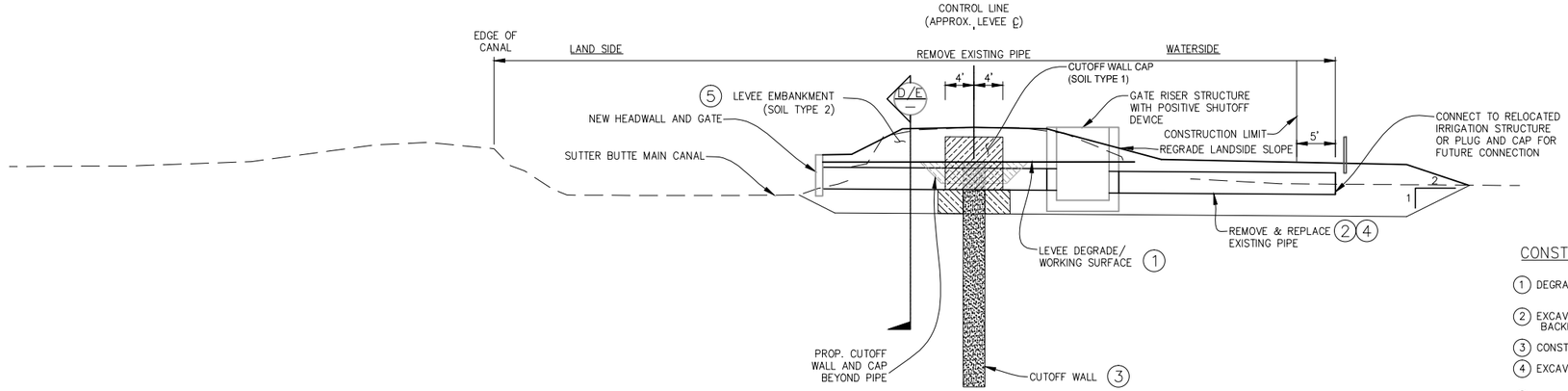
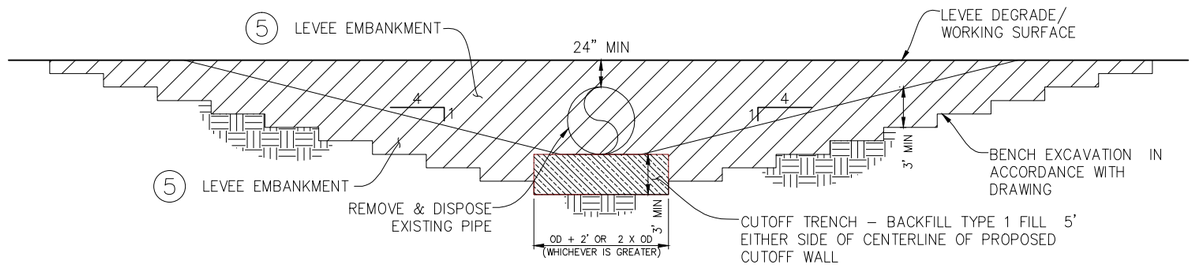


PLATE G-3F: TYPICAL REMOVAL & REPLACEMENT OF THROUGH PIPE ADJACENT TO CANAL (TYPE 3B)

SCALE: NONE

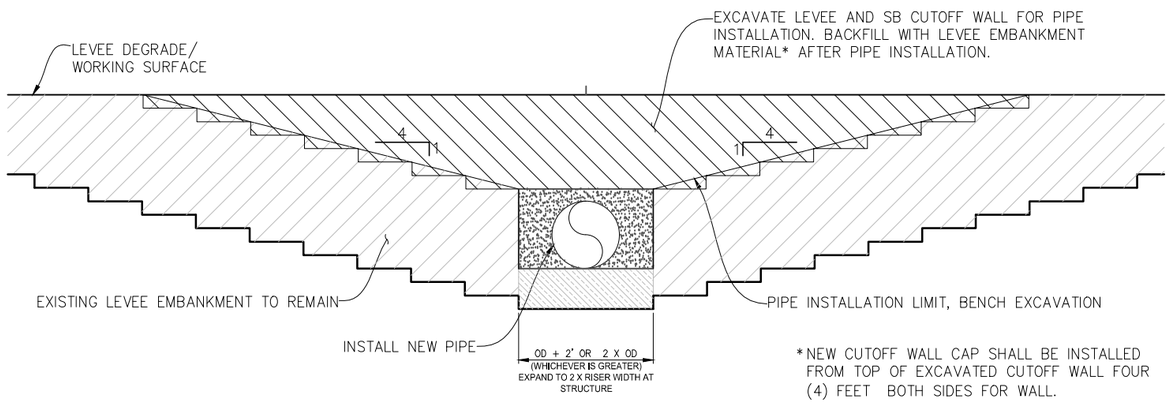
CONSTRUCTION SEQUENCE:

1. DEGRADE EXISTING LEVEE.
2. EXCAVATE, REMOVE AND DISPOSE OF EXISTING PIPE OFFSITE, AND BACKFILL UP TO WORKING SURFACE.
3. CONSTRUCT CUTOFF WALL.
4. EXCAVATE, INSTALL NEW PIPE AND BACKFILL UP TO WORKING SURFACE.
5. RECONSTRUCT LEVEE EMBANKMENT FOR AREA EXCAVATED FOR PIPE AND RISER INSTALLATION.



SECTION D

SCALE: NONE



*NEW CUTOFF WALL CAP SHALL BE INSTALLED FROM TOP OF EXCAVATED CUTOFF WALL FOUR (4) FEET BOTH SIDES FOR WALL.

SECTION E

SCALE: NONE

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Symbol	Description	Date	Approved
D8	DESCRIPTION8	DATE8	APPROVAL8
D7	DESCRIPTION7	DATE7	APPROVAL7
D6	DESCRIPTION6	DATE6	APPROVAL6
D5	DESCRIPTION5	DATE5	APPROVAL5
D4	DESCRIPTION4	DATE4	APPROVAL4
D3	DESCRIPTION3	DATE3	APPROVAL3
D2	DESCRIPTION2	DATE2	APPROVAL2
D1	DESCRIPTION1	DATE1	APPROVAL1

Designed by: –
Dwn by: –
Reviewed by: –
Submitted by: –
CHIEF, CIV ENGR DES SEC A

Date: –
Spec No.: –
Design file no: –
Drawing Code: –
File name: $$$$confSS
Plot date: $$$$confSS
Plot scale: –
Rev: –

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SUTTER & BUTTE COUNTY CALIFORNIA
SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX
PLATE G-3F
TYPICAL UTILITY IMPROVEMENT – REMOVAL AND REPLACEMENT OF THROUGH PIPE ADJACENT TO CANAL

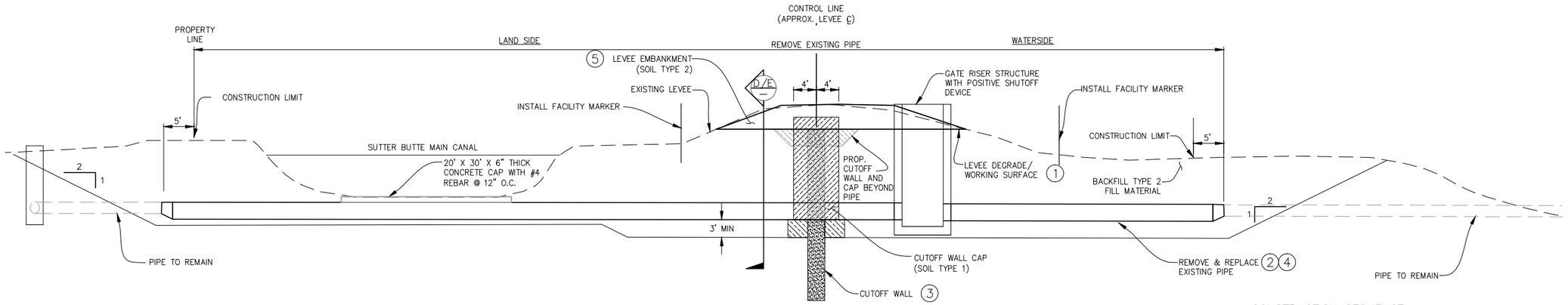
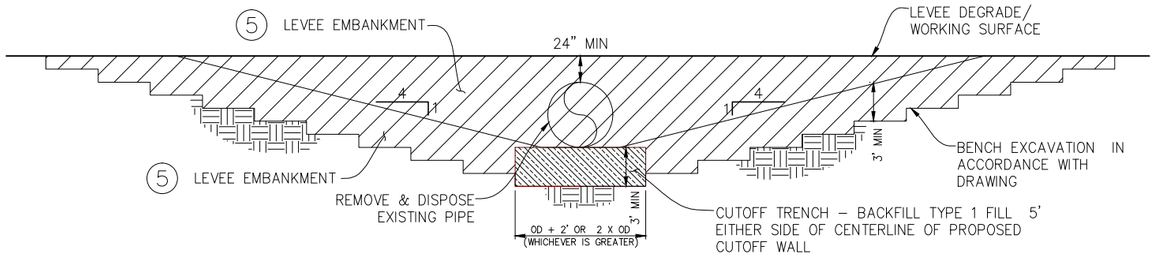


PLATE G-3G1: TYPICAL REMOVAL & REPLACEMENT OF THROUGH PIPE UNDER CANAL (TYPE 3C1)

SCALE: NONE

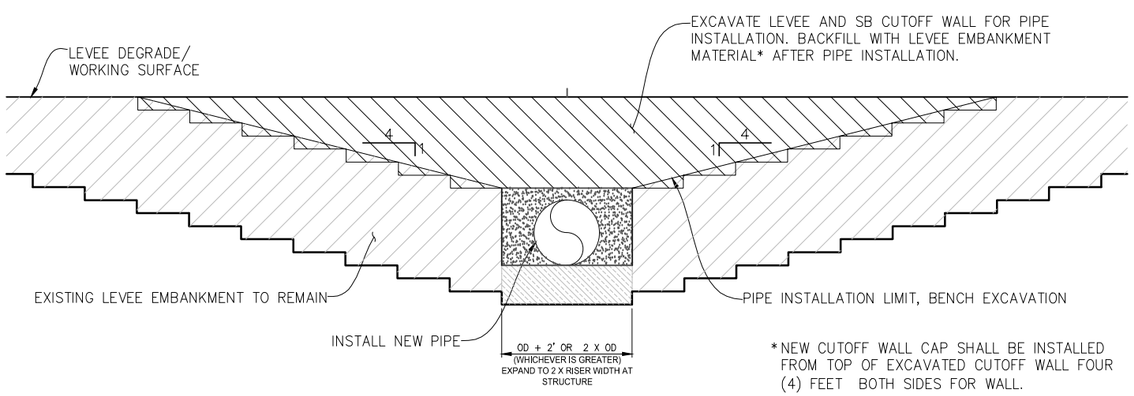
CONSTRUCTION SEQUENCE:

1. DEGRADE EXISTING LEVEE.
2. EXCAVATE, REMOVE AND DISPOSE OF EXISTING PIPE OFFSITE, AND BACKFILL UP TO WORKING SURFACE (SEE SECTION D).
3. CONSTRUCT CUTOFF WALL.
4. EXCAVATE, INSTALL NEW PIPE AND BACKFILL UP TO WORKING SURFACE (SEE SECTION E).
5. RECONSTRUCT LEVEE EMBANKMENT FOR AREA EXCAVATED FOR PIPE AND RISER INSTALLATION.



SECTION D

SCALE: NONE



*NEW CUTOFF WALL CAP SHALL BE INSTALLED FROM TOP OF EXCAVATED CUTOFF WALL FOUR (4) FEET BOTH SIDES FOR WALL.

SECTION E

SCALE: NONE

US Army Corps of Engineers
Sacramento District

Symbol	Description	Date Approved
DA	DESCRIPTION8	DATE8 APPROVAL
D7	DESCRIPTION7	DATE7 APPROVAL
D6	DESCRIPTION6	DATE6 APPROVAL
D5	DESCRIPTION5	DATE5 APPROVAL
D4	DESCRIPTION4	DATE4 APPROVAL
D3	DESCRIPTION3	DATE3 APPROVAL
D2	DESCRIPTION2	DATE2 APPROVAL
D1	DESCRIPTION1	DATE1 APPROVAL

Designed by: –
Dwn by: –
Reviewed by: –
Submitted by: –
Date: –
Spec No.: –
Design file no: –
Drawing Code: –
File name: $$$$dwf$$$$
Plot date: –
Plot scale: –
Rev: –
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ENGINEERING APPENDIX
PLATE G-3G1
TYPICAL UTILITY IMPROVEMENT – REMOVAL AND REPLACEMENT OF THROUGH PIPE UDNER CANAL

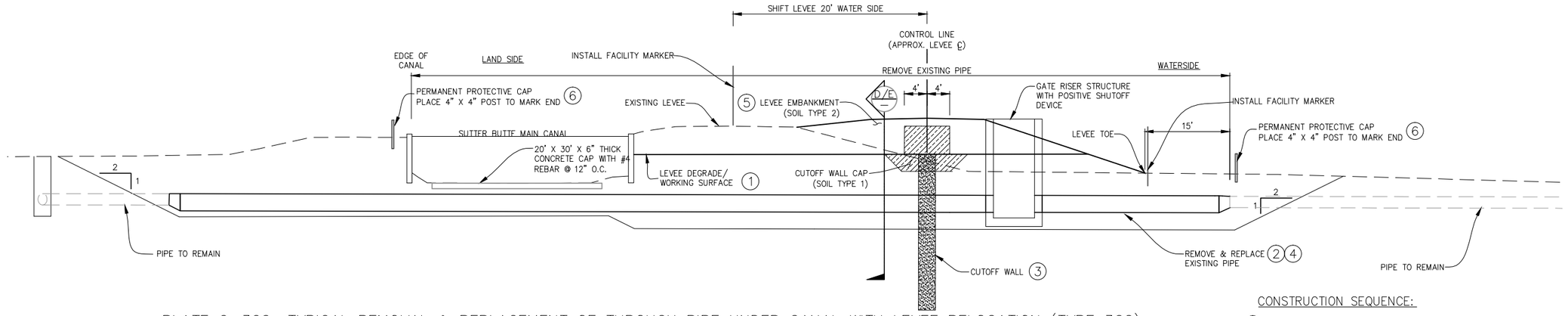
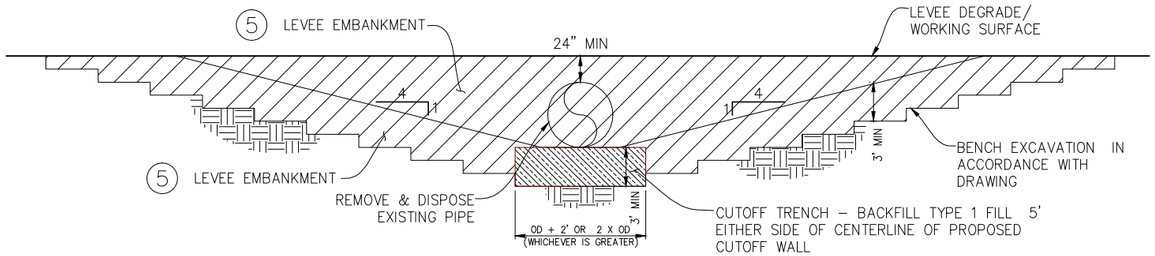


PLATE G-3G2: TYPICAL REMOVAL & REPLACEMENT OF THROUGH PIPE UNDER CANAL WITH LEVEE RELOCATION (TYPE 3C2)

SCALE: NONE

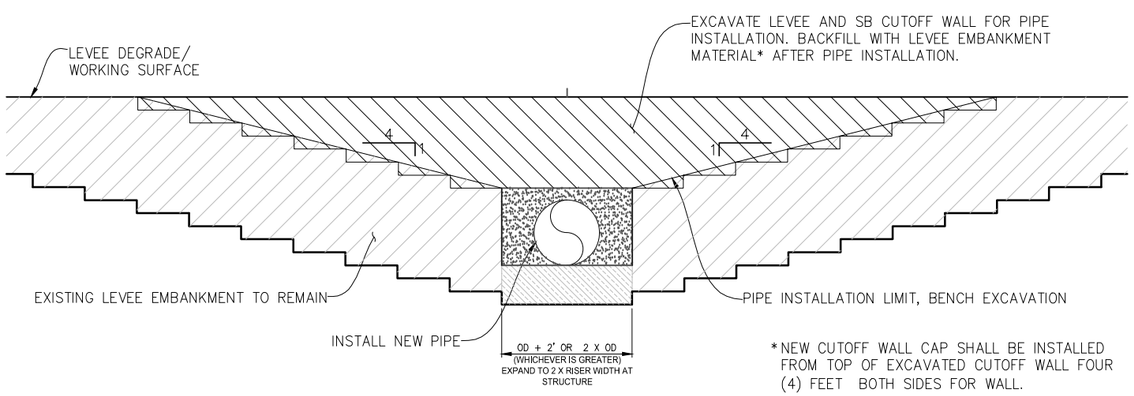
CONSTRUCTION SEQUENCE:

1. DEGRADE EXISTING LEVEE.
2. EXCAVATE, REMOVE AND DISPOSE OF EXISTING PIPE OFFSITE, AND BACKFILL UP TO WORKING SURFACE (SEE SECTION D).
3. CONSTRUCT CUTOFF WALL.
4. EXCAVATE, INSTALL NEW PIPE AND BACKFILL UP TO WORKING SURFACE (SEE SECTION E).
5. RECONSTRUCT LEVEE EMBANKMENT FOR AREA EXCAVATED FOR PIPE AN RISER INSTALLATION.
6. EXCAVATE, INSTALL NEW PIPE, CONNECT TO EXISTING PIPE, INSTALL MARKER AND BACKFILL



SECTION (D/—)

SCALE: NONE



*NEW CUTOFF WALL CAP SHALL BE INSTALLED FROM TOP OF EXCAVATED CUTOFF WALL FOUR (4) FEET BOTH SIDES FOR WALL.

SECTION (E/—)

SCALE: NONE

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Symbol	Description	Date
DA	DESCRIPTION8	DATE8 APPROVAL
DZ	DESCRIPTION7	DATE7 APPROVAL
DG	DESCRIPTION6	DATE6 APPROVAL
DF	DESCRIPTION5	DATE5 APPROVAL
DA	DESCRIPTION4	DATE4 APPROVAL
DA	DESCRIPTION3	DATE3 APPROVAL
D2	DESCRIPTION2	DATE2 APPROVAL
D1	DESCRIPTION1	DATE1 APPROVAL

Designed by: –
Dwn by: –
Reviewed by: –
Submitted by: –
Date: –
Spec No.: –
Design file no: –
Drawing Code: –
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Plot date: –
Plot scale: –
Chief, Cov Engr Des SEC A

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SUTTER & BUTTE COUNTY CALIFORNIA
SUTTER BASIN PILOT FEASIBILITY STUDY
ENGINEERING APPENDIX
PLATE G-3G2
TYPICAL UTILITY IMPROVEMENT – REMOVAL AND REPLACEMENT OF THROUGH PIPE UDNER CANAL W/LEVEE RELOCATION